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I. *A Vocabulary of the Dialect spoken by the* TODAS *of the* NILAGIRI *mountains. By the Rev.* F. METZ *of the German Evangelical Mission.*

[*Continued from* Vol. I. p. 146.]

I.

I (personal pronoun) ఆన్. *án.*
Ibex బరార్. *barár.*
Ice అర్ర్. *arr.*
Idle సోమారి. *sómári.*
Ichneumon కీర్పెష్క్. *kírpeshk.*
If యోర్ or నోర్. *yór or nór.*
Illness నూఫ్. *núf.*
Impede బలిగడెర్ష్బిని. *baligadershbini.*
Impotent, (verb imperson.) బుడివార్ష్విచి. *budivárshvichi.*
Improper సరిఆఖడి. *sariákhadi.*
Improve ఉల్టాయిస్బిని. *ultáyisbini.*
Impure జిపిజ్. *jipij.*
Incense దూప్. *dúp.*
Increase బెళెదువెర్ష్బిని. *beleduvershbini.*
Indecent నానిల్లాదె. *nánilláde.*
Inflamation కావ్. *káv.*
Infant female మినిక్. *minik.*
Infant male పోపన్. *pópan.*
Informer జాడికారన్. *jádikáran,* మొరెకారన్. *morekáran.*
Insufficient యెత్తియాడి. *yettiyádi.*
Ink కరి. *kari.*
Insensible నానం అరివిచి. *nánam arivichi.*

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Insane	పుచ్చ్ హిదిద్విచి.	*puchch hiḍidvichi.*
Interest	బడ్డి.	*baḍḍi.*
Inward	ఉఴ్వఴ్.	*uzhvazh.*
Ire	బిజ.	*bija.*
Iron	కబ్బున్.	*kabbun.*
Itch	గజ్జి.	*gajji.*
Iris of the eye	కంణ్ మొఖ్.	*kaṇṇ mokh.*

J.

Jackal	నరి.	*nari.*
Jack fruit	పర్షవుపోం.	*parshavupóm.*
Jest	నార్బిని. *nárbini,* గుట్సెర్ష్బిని.	*gutsershbini.*
Join	కూట్స్బిని.	*kúṭsbini.*
Journey	పయణ.	*payaṇa.*
Joy	వొల్స్తి. *volsti,* చచ్చోష్.	*chachchósh.*
Jug	అడిగి.	*aḍigi.*
Juice	కఱ్.	*karr.*
Jump	ఎల్థివెర్ష్బిని.	*elthivershbini.*
Justice	నాయం.	*náyam.*

K.

Keep	కాట్స్బిని.	*káṭsbini.*
Key	టెర్ప్.	*terp.*
Kick	బఫ్థ్బిని.	*bafthbini.*
Kill	బేష్ట్వెర్ష్బిని.	*béshtvershbini.*
Kind (noun)	మాదరి.	*mádari.*
Kindness	దయం.	*dayam.*

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Kindred	పైయాళ్.	*paiál.*
King, Gentleman	అరస్.	*aras.*
Kiss	బీర్వెర్ష్బిని.	*bírvershbini.*
Knee	మిగ్ము.	*migmu.*
Kneel	మిగ్ము ఊర్స్బిని.	*migmu úrsbini.*
Knock	కుట్టివెర్ష్బిని.	*kuṭṭ'hivershbini.*
Know	అర్థ్బిని.	*arthbini.*
Knife	జూరి.	*júri.*

L.

Ladder	యేనిల్.	*yénil.*
Lake	కేర్.	*kér.*
Language	బాష్.	*básh.*
Large	ఎతుడ్.	*etuḍ.*
Late	తడెయాయి.	*taḍeyáyi.*
Law suit	పిరియాడి.	*piriyádi.*
Lead (noun)	తీసలు.	*tísalu.*
Leap	ఎల్థివెర్ష్బిని.	*elthivershbini.*
Leaf	ఎళ్.	*ezh.*
Leather	తూవళ్.	*túvazh.*
Leave	బుట్క్విట్స్బిని.	*butt'k vitt'hsbini.*
Leech	ఎపుఫ్.	*epuf.*
Left	ఎడ్డ.	*edda.*
Leg	కాల్.	*kál.*
Lemon	యిళ్మిచ్చ్.	*yizhmichch.*
Leopard	కిర్మెన్.	*kirmen.*

Leprosy కుట్హ్నూఫ్. *kuṭṭ'hnúf.*

Liar పెర్కిటి. *perkiti.*

Lie down వొరక్హెని. *vorak'heni,* వొరక్హ్స్బిని. *vorak'hsbini.*

Life తీవ్. *tív.*

Lift up తూఖ్స్బిని. *túkhsbini.*

Lime, chalk నూర్. *núr.*

Limit, boundary తెవరు. *tevaru.*

Lips కుఴ్హ్వాయి.. *kuẓhváyi,* మేల్వాయి. *mélváyi,* under and upper lip.

Listen వోరాట్స్బిని. *vóráṭsbini.*

Little యెద్ది. *yeddi.*

Lizard వోశి. *vóṣi,* కెజల్సూన్. *kejalsún.*

Load పర్ర. *parra.*

Lock, key తెర్ప్. *terp.*

Long నెర్రిగిట్టి. *nerrigitti.*

Look నోట్స్బిని. *nóṭsbini.*

Loosen బిసెర్ష్బిని. *bisershbini,* బుట్హ్యిట్హ్స్బిని. *butt'h yiṭṭ'hsbini.*

Loud వుళ్కిగదార. *vuḷkigadára.*

Louse పేన్. *pén.*

Love పేర్వెర్ష్బిని. *pérvershbini.*

Lust ఆవెల్. *ável.*

Lake కేర్. *kér.*

Labour, work, (verb) గిర్థ్బిని. *girthbini.*

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M.

Mad ಪೆರದ್. *perad,* ಪುಚ್ಚನ್. *puchchan.*

Make ಮಾಡ್ಥ್ಬಿನಿ. *mádthbini.*

Malediction ಪರ್ಥಿಟಿ. *parthiti.*

Malice (I have) ಕಣ್ಣುಕಾರ್ಥ್ಬಿನಿ. *kannıkárthbini.*

Man ಆಳ್. *ál.*

Mango ಮಾಫ್ಮೇನ್ಪೋಂ. *máfménpóm.*

Many ಉಪಾಂ. *upám.*

Marry ಮೆತ್ವೆರ್ಷ್ಬಿನಿ. *methvershbini,* ಯೆನಗ್ ಕುಖ್ ಕಾತೆರ್ಷ್ಬಿನಿ. *yenag kukh kátershbini.*

Marriage ಮೆತ್. *meth.*

Marsh, swamp ಕೆನ್ನೇರ್. *kennér.*

Mat ಮಂದರಿ. *mandari.*

Matter ಗೀಫ್. *gíf.*

Meat ಬುವದ್. *buvad.*

Measles ಚಿಕ್ಕಮ್ಮ. *chikkamma.*

Medicine ಮದ್ದ್. *madd.*

Meet ಎರಾಚ್ಕದ್ದೆರ್ಷ್ಬಿನಿ. *eráchkaddershbini.* lit. I see half way.

Melt ಕರ್ಗ್ಸ್ಬಿನಿ. *kargsbini.*

Milk (noun) ಪಾೞ್. *pázh.*

Milk (verb) ಕರ್ರ್ಸ್ಬಿನಿ. *karrsbini.*

Miscarry ಮೊಖ್ಬುಡದ್ವೆಷ್ಚಿ. *mokhbudadweshchi.* lit. the child has fallen down.

Might ದದ್ದಂ. *daddam.*

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Mist	మజ్జ్. *majj.*
Mind	మనసు. *manasu.*
Mind to	ఉన్స్బిని. *unsbini.*
Miser	కరి. *kari.*
Mock	కొంస్బిని. *komsbini.*
Mocking	కొంజాన్. *konján.*
Money	పణం. *paṇam.*
Moment	యిన్నర్గల్లి. *yinnargalli.*
Monkey	కోడన్. *kóḍan.*
Moon	తిగ్గళ్. *tiggal.*
Month	తెల్దు. *teldu.*
Morning	బెళితాష్. *beḷitásh.*
Morrow to	మకాళ్. *makáḷ.*
Mother	అవ్వ్. *avv.*
Motherless, orphan	తొబ్బరిమొఖ్. *tobbarimokh.*
Mourn	ఆట్స్బిని. *áṭsbini.* (lit. I play.)
Mouse	యిళ్. *yizh.*
Mouth	బొయి. *boyi.*
Muscle	నర్బు. *narbu.*

Mount హత్తిబోకెన్. *hattibóken,* మొక్బోకెన్. *mokbóken.*

Mountain బన్న. *banna,* డాల్ట. *dálta,* మర్ష్. *marsh.*

Must బేక్. *bék.* must not కుళ్ళ. *kuḷḷa.*

Mute బొక్క్. *bokk.* Be quiet, బొక్కిర్. *bokkir.*

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N.

Nail	యిఴ్. *yizh.*
Naked	బథుగుపి. *bathugupi.*
Name	పేర్. *pér.*
Narrative	కథ్. *kat'h.*
Nation, tribe	కుళ్. *kuḷ.*
Naught (it is)	యేనమాడడి. *yenamáḍaḍi.*
Navel	బుక్కు. *bukku.*
Near	కెఖురి. *kekhuri.*
Neat	నార్ష్టి. *nárshti.*
Neck	నాడి. *náḍi.*
Needle	ఎబ్బ్. *ebb.*
Neighbour	నెరబాల్తి ఆళ్. *nerabálti áḷ.*
Nest	గూడ్. *gúḍ.*
Never	ఎత్వను. *etwanu.*
New	పుథు. *puthu.*
News	సుద్ది. *suddi.*
Nickname	కాస్ పేర్. *káspér.*
Night	కగ్గార్. *kaggár.* dark ఇఴిల్త్. *yzhilt.*
Nine	ఉన్బొథ్. *unboth.*
Nineteen	పొన్బొథ్ *pónboth.*
Ninety	ఏన్బొథ్. *énboth.*
Noise	దని. *dani.*
Noon	ఉష్కి. *ushki.*

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North	బడగు.	*badagu.*
Nose	మితుఫ్.	*mituf.*
Nostrils	మితుఫ్తిల్తి.	*mituftilti.*
No, not	ఆడది.	*ádadi.* (అ with a shake of the head.)
Nothing, for	పెరాది.	*perádi.*
Nourish	తాడెర్ష్బిని.	*tádershbini.*
Now	ఏని.	*éni.*

O.

Oath I make బర్థ్బిని. *bārthbini,* సత్యమాడ్స్బిని. *satya-mádsbini.*

Ocean	సౌందురు.	*sounduru.*
Oil	ఎంణ్ణై.	*ennai.*
Old	పార్ర్.	*párr.*
Omen	సగుని.	*saguni.*
One	వొడ్డ్.	*vodd.*
Onion	ఊల్డి.	*úldi.*
Open	తర్ర్స్బిని.	*tarrsbini.*
Once	ఉన్నర్.	*unnar.*
Orient	మూడి.	*múdi.*
Order, to	అపణెమాడ్స్బిని.	*apanemádsbini.*
Other	యిన్నొడ్డ్.	*yinnodd.*
Outside	పొర్ర్మొచ్.	*porrmoch.*
Over	మొక్.	*mok.*
Owl	గుమ్మన్.	*gumman.*
Ox	ఎష్ట్.	*esht.*

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P.

Pain — పాడ్థ్తి. *pádthti.*

Palace — కువట్. *kuvat.*

Palate — కిర్ర్నాళంగి. *kirrnálangi.*

Paper — కాగచ్. *kágach.*

Parasite — దిబిటి. *dibiti.*

Part — పాలు. *pálu.*

Passion — బిజ్జు. *bijju.*

Path — కింనాల్డార్. *kinnáldár.*

Pawn — బెక్క్. *bekk.*

Pawn, verb — బెక్క్టష్క్కెన్. *bekktashkken.*

Peaceful — ఉళ్ట్. *ult.*

Peacock — మీర్ష్. *mírsh.* (with the teeth shut) vide hare మీర్ష్.

Pearl — ముట్టు. *muttu.*

Pen, feather — టూఫ్. *túf.*

Penis — బుడి. *budi.*

Pepper — పెర్కి. *perki.*

Perspiration — ఉరి. *uri.*

Perish — కేడావెర్ష్బిని. *kédávershbini.*

Piece — టుండు. *tundu.*

Pig — పడ్డి. *paddi.*

Pilfer — కడదివెర్ష్బిని. *kadadivershbini.*

Pinch — నెర్బ్స్బిని. *nerbsbini.*

Pipe — క్వేఴ్ష్. *kwézhsh,* క్వేఴ్త్. *kwézht.*

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Piss పిస్కెత్వష్కెన్. *pisketvashken.*

Pit కుడి. *kuḍi.*

Place తావు. *távu.*

Plantain పెవోం. *pevóm.*

Play ఆట. *áṭa.*

Play, verb ఆట్స్బిని. *áṭsbini,* నార్స్బిని. *nársbini.*

Plenty ఉపాం. *upám.*

Pledge పొంను. *poṇṇu,* (verb) పొంనుగారనాయిస్బిని. *poṇṇugáranáyisbini.*

Plough నెఖెల్. *nékhel.*

Plough, verb ఉఴ్థ్బిని. *uzhthbini.*

Pocket కువష్. *kuvash,* కిర్ర. *kirra,*

Point out కాట్స్బిని. *kátsbini.*

Poison నంజు. *nanju,* బిస్సం. *bissam.*

Pond కెర్. *kér.*

Poor కెలెఆళ్. *keleáḷ,* బెడుగారన్. *Béḍugáran,* బడువన్. *baḍuvan.*

Potter కుంమారన్. *kummáran.*

Porcupine ముళ్లంది. *muḷḷandi.*

Pour అట్ట్స్బిని. *aṭṭ'hsbini.*

Portion పాలు. *pálu.*

Post to నిల్లిస్బిని. *nillisbini.*

Prepare వొళ్గెసిట్ట్స్బిని. *voḷtgesiṭṭ'hsbini*

Pride కువఫ్. *kuvaf.*

Pray పర్థ్స్బిని. *parthsbini.*

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Property ఆస్తి. *ásti.*

Prostrate అడ్డబుద్థ్బిని. *aḍḍabudthbini.* కాల్మెల్బుద్థ్బిని. *kálmelbudthbini.*

Proud కువఫస్తి. *kuvafasti.* (it is pride).

Prove రుజగెర్ష్బిని. *rujagershbini.*

Pull బత్స్బిని. *batsbini.*

Pulse కైనాతి. *kaináti.*

Purchase బెలెగ్వొత్యెత్స్బిని. *belegwotyetsbini.*

Purge బీరుట్ట్హెవిచి. *bíruṭṭ'hevichi.*

Purse కైతీరం. *kaitíram.*

Push తల్లిస్బిని. *tallisbini.*

Putrid (it is) కొడుడువిచి. *kọduduvichi.*

Pygmy కురుడ్. *kuruḍ.*

Q.

Quake అఫ్ద్థ్బిని. *afdthbini.*

Quick బెరెండ్. *berend.*

Quench, spoil కెట్ట్హ్స్బిని. *keṭṭ'hsbini.*

Quite యెల్లా. *yellá.*

R.

Rage (verb) బిజవెర్ష్బిని. *bijavershbini.*

Rain మా. *má.*

Rain (verb) ఊడుతి. *úḍuti.*

Rainbow కువర్ వొర్ర్వర్ష్. *kuvar vorrvarsh.*

Raise తూఖ్స్బిని. *túkhsbini,* ఎత్స్బిని. *ettsbini.*

Raspberry ముఴ్పోం. *muzhpóm.*

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Recite	బిందివెర్ష్బిని. *bindivershbini.*
Recollection	నెప్పు. *neppu.*
Run	వొట్స్బిని. *vóṭsbini.*
Rat	యిఝ్ఝ్. *yizhzh.*
Razor	తర్ష్వాల్ట్. *tarshvált.*
Reconcile	వొడ్డెగెర్ష్బిని. *voddegershbini.*
Red	కెప్పు. *keppu.*
Refuse	కుళది ఎష్ట్స్బిని. *kuḷadi eshtsbini.*
Regulate	సరిమాడ్స్బిని. *sarimáḍsbini.*
Release	బుట్ట్వెర్ష్బిని. *buṭṭ'hvershbini.*
Require	బేకెష్ట్స్బిని. *bĕkeshtsbini.*
Rend, tear	కీరివెర్ష్బిని. *kírivershbini.*
Rhododendron	బిర్ష్మేన్. *birshmén.*
Rheumatism	సణి. *saṇi.*
Rib	మురిఎల్ఫ్. *murielf.*
Riches	ఎతుద్ ఆస్తి, *etud ásti.*
Right	సరి. *sari.*
Right hand	బఝ్కై. *bazhkai.*
Ring	ఎబ్బల్. *ebbal.*
Rise	ఎడదెర్ష్బిని. *eḍadershbini.*
River	పా. *pá.*
Road	ఆల్డార్. *áḷdár.*
Roar	కెండ్ధ్బిని. *kenddhbini.*
Rock	అర్రె. *arre.*
Roof	బర్రి. *barri,* వర్రి. *varri.*

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Root — బేర్. *bér.*
Rope — హగ్గం, *haggam,* కణ్ణి. *kaṇṇi.*
Rose — కడెగ్పూజ్. *kaḍegpúj.*
Rotten — కెతలావిచి. *ketalávichi.*
Rub — కీత్స్బిని. *kítsbini.*
Rubbish — గెబ్బు. *gebbu.*
Ruminate, 3d. pers. — మేల్గెర్చి. *mélgerchi.*
Run away — వోడ్స్బిని. *vóḍsbini.*
Rust — బొర్గ్. *borg.*
Rusty (it is) — బొర్గెవిచి. *borgevichi.*

S.

Sack — తీరం. *tíram.*
Salep plant — తిర్కల్తూర్. *tiṛkaltúr.*
Saliva — యెజ్జలు. *yejjalu.*
Salt — ఉప్పు. *uppu.*
Salute — కుబ్బుట్టిహిఖెన్. *kubbuṭṭ'hikhen,* సలాంగెర్ష్బిని. *salámgershbini.*
Sand — ఏర్మొల్. *érmol.*
Saturday — శని. *sani.*
Satisfied (not hungry) — బీర్వఖ్స్విచి. *bírvakhsvichi.*
Sauce, curry — కారం. *káram.*
Scatter — బీరివెర్ష్బిని. *bírivershbini.*
Scratch — కుల్తూరెర్ష్బిని. *kuḷtúrershbini,* ఎత్స్బిని. *ets bini.*
Scent — మూద్థ్తి. *múdthti.*
Scent, imperson. — మూక్వెర్ష్చి. *múkvershchi,*
Scorpion — కిర్ర్షూర్. *kirrshúr.*

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Scull మద్దెల్లు. *maddellu.*

Seal ముదురుం. *mudurum.*

See నోట్స్బిని. *nóṭsbini.*

Sell మారివిట్ఠికెన్. *mariviṭṭ'hiken.*

Seize బట్స్బిని. *baṭsbini.*

Send బోఖెద్దెష్ట్స్బిని. *bókheddeshtsbini.* (go I say)

Sentry కావల్గారన్. *kávalgáran.*

Set (the sun sets) (బీఴ్) బిడిదువెథ్చి. *(bízh) biḍidu-vet'hchi.*

Seven య్ఝేఴ్. *yzhézh.*

Seventeen పార్ర్. *párr.*

Seventy ఏఴ్ఝోథ్. *ézhzhoth.*

Sew కుట్కూట్స్బిని. *kutkúṭsbini.*

Shade, shadow నేర్ష్. *nérsh.*

Shake అలిక్స్బిని. *aliksbini.*

Shame నానం. *nánam.*

Shameless నానిల్లాదె. *nánilláde.*

Shave బాన్స్బిని. *bánsbini.*

She అథ్. *ath.*

Shell తెంగి. *tengi.*

Ship కబల్. *kabal.*

Short కుర్గిటి. *kurgiti.*

Shoulder నెబ్కోడ్. *nebkóḍ.*

Show కాడ్స్బిని. *káḍsbini,* neuter తువర్ష్చి. *ṭuvarshchi.*

Shrub డొబ్బి. *dobbi.*

Shut	ముచ్ విట్ట్స్బిని.	*muchviṭṭ'hsbini.*
Sick	బార్ధ్బిని.	*bárdthbini.*
Sickle	కాడర్టి.	*káḍarti.*
Side	బిర్ష్క్.	*birshk.*
Sigh	నరిగిస్బిని.	*narigisbini.*
Sight	నోట్.	*nóṭ.*
Sign	గుర్ట్.	*gurt.*
Silent, I am	బోటెర్ష్బిని.	*botershbini.*
Silver	బిళ్టి.	*biḷti.*
Sin	పాపం.	*pápam.*
Single	వొడ్డియాల్.	*voddiál.*
Sister	ఎన్నోర్వెట్కుఖ్.	*ennorvetkukh.*
Sit	ఎర్ష్కెన్. *ershken,* ఎటర్స్బిని.	*etarsbini.*
Six	ఆరు.	*áru.*
Sixteen	పేఴ్.	*pézh.*
Sixty	ఆరొథ్.	*ároth.*
Skin	తువర్ష్.	*tuvarsh.*
Sky	బాన్.	*bán.*
Slay	బీష్కెర్ష్బిని.	*bíshkershbini.*
Sleep	వొర్ఖెన్. *vorkhen,* వొర్ఖ్స్బిని.	*vorkhsbini.*
Slide, slip	ఎక్ఖ్హివెర్ష్బిని.	*ek'hk'hivershbini.*
Slippery (it is)	ఎక్ఖ్హిచి.	*ek'hk'hichi.*
Slope	వోరె.	*vóre.*
Slow	మెల్లి.	*melli.*
Small	సినుద్,	*sinud.*

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Smarts, it	వాస్చి. *váschi.*
Smell (good)	ద మొతి. *damoti.*
Smell, bad	జిడివొతి. *jiḍivoti.*
Smile	కార్ద్థ్బిని. *kárdthbini.*
Smoke	పొఖ్. *pokh.*
Snake	పాబ్. *páb.*
Sneeze	తిపెర్ష్బిని. *tipershbiṇi.*
Snore	కర్స్బిని. *karsbini.*
So	యింగై. *yingai,* అంగై. *angai.*
Son	మొఖ్. *mokh.*
Sorcerer	బిలికారన్. *bilikáran.*

Sorcery (he practices) వొర్ష్చి. *vórshchi.* the Curumba enchants. కుర్ఫ్ వొర్ష్చి. *Kurf vórshchi.*

Soul	ఉస్సురు. *ussuru,* జీవ్. *jív.*
Soil	బుమి. *bumi.*
Sour (it is)	బుళ్త్సడె. *buḷtsade.*
Sorry, I am	దుఖం ఎర్ష్బిని. *dukham ershbini.*
South	తెక్కు. *tekku.*
Sow, I	బుత్త్స్బిని. *buttsbini.*

Speak అర్వొద్థ్బిని. *arvodthbini,* అర్వొర్ష్బిని. *arvorshbini.*

Spear	యిట్ట్. *yiṭṭ'h.*
Spend	బీసెర్ష్బిని. *bísershbini.*
Speech	బాష్. *básh,* పర్స్ంగ్. *parsng.*

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Spine	బేనుబ్. *bénub.*
Spittle	దివొన్. *divon,* దివొతి. *divoti.*
Spit	దివొర్ష్బిని. *divorshbini.*
Spider	త్వాల్జెన్. *twáljen.*
Spoil	కెడిచెర్ష్బిని. *keḍichershbini.*
Spot	తావ్. *táv,* తాఫ్. *táf.*
Staff	కోలు. *kólu.*
Stand	నెల్ల్స్బిని. *nellsbini.*
Star	మీన్. *mín.*
Spread	బీర్స్బిని. *bírsbini.*
Sprinkle	గిత్స్బిని. *gitsbini.*
Squeeze	నెర్బస్బిని. *nerbasbini.*
Squeak	బిల్త్స్బిని. *biltsbini.*
Starve	బీర్ ఏర్ద్థ్తి. *bír érdthti.*
Steal	కడెదువెర్ష్బిని. *kaḍeduvershbini.*
Steel	ఉష్క్. *ushk.*
Steep	డాళ్ట్. *dáḷt.*
Stench	జిడి. *jiḍi.*
Stink	జిడిబుట్ట్స్బిని. *jiḍibuṭṭ'hsbini.*
Step (noun)	హెజ్జె. *hejje.*
Sting	కుద్థ్వెర్ష్బిని. *kudthvershbini.*
Stool (to go to)	త్వార్ష్బోకెన్. *twárshbóken.*
Stone	కల్ల్. *kall.*
Stop	పార్వద్థ్బిని. *párvadthbini.*
Storm	కాట్. *kát.*

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Straw — ముర్థ్ఱ. *murth,* పుల్లు. *pullu.*

Stream — పా. *pá.*

Strike — పుయిస్బిని. *puyisbini.*

String — నారు. *náru.*

Strong (man) — తాత్మోరాళ్. *tátmoraḷ.*

Suck (calf) ఎక్హ్స్తి. *ek'hsti,* (child) మోర్ష్ ఊట్య్తి. *morsh úṭyti.*

Sugar — కబొటి. *kaboṭi.*

Sun — బీఴ్. *bízh.*

Sunday — ఆడ్స్వోం. *ádsvóm.*

Sure — నేజాని. *néjáni.*

Swallow — నుగ్గివిట్ట్హ్స్బిని. *nuggiviṭṭ'hsbini.*

Swamp — కెం నేర్. *kennér.*

Sweat — ఉరి. *uri.*

Sweep — దండెర్ష్బిని. *dandershbini.*

Sweet — దిజతి. *dijati.*

Swell — బాద్థ్చి. *bádthchi.* (it swells.)

Tail — బార్ష్ం. *bárshm.*

Take — తెగ్స్బిని. *tegsbini.*

Tall నిర్రిగితి. *nirrigiti;* I am tall, నిర్రిగివెర్ష్బిని. *nirrigivershbini.*

Talk — ఎష్ట్స్బిని. *eshtsbini.*

Tamarind — బుళ్తి. *buḷti.*

Tax — బేర్వన్. *bérvan.*

Thatch — పుల్లుబేర్స్బిని. *pullubérsbini.*

Tempest — కాట్. *kát.*

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Ten	పథు. *pathu.*
Thirst	నిర్ఖాస్తి. *nírkhásti.*
There	అల్లి. *alli.*
Thief	కళ్ళన్. *kaḷḷan.*
Thirteen	పొన్మూడ్. *ponmúḍ.*
Thirty	ముబొత్. *muboth.*
Tie	కట్ట్హ్స్బిని. *kaṭṭ'hsbini.*
Thorn	ముళ్ట్. *muḷt.*
Thistle	నెఖ్. *nekh.*
Thread	నూఴ్. *núzh.*
Three	మూడు. *múḍu.*
Thumb	బెవెళ్. *beveḷ.*
Thunder	ఎఱ్రి. *erri.*
Thunders, it	ఎఱ్రిఎర్ద్థ్తి. *errierdthti.*
Time	కాల్. *kál.*
Tiger	బిర్ష్. *bírsh.*
Tinder	తూధి. *túdhi.*
Tobacco	బొఖ్. *bokh,* బఖ్. *bakh.*
Token	కుర్ప్. *kurp.*
Toll, custom	సుక్కం. *sukkam.*
Tongue	నాఫ్. *náf.*
Tooth	పఱ్ష్. *parrsh.*
Touch	ముట్ట్హ్స్బిని. *muṭṭ'hsbini.*
Tower	గోపురు. *gópuru.*
Town	ఊర్. *úr.*
Transgression	త్వఱ్. *twarr.*

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Trap — గూడు. *gúḍu.*

Treasure — బథక్. *bathak.*

Tree — మేన్. *mén.*

Tremble — వోఫ్స్బిని. *vófsbini.*

True — నేధాని. *nédháni.*

Trust — నబ్బ్స్బిని. *ṅabbsbini.*

Truth — సత్యం. *satyam.*

Tumble — బుదుదువెర్ష్బిని. *bududuvershbini.*

Turban — మండెపారి. *mandepári.*

Tusk — కొబ్బు *kobbu.*

Turn — తిర్క్స్బిని. *tirksbini.*

Twelve — పొన్నెడ్. *ponneḍ.*

Twenty — ఎవొథ్. *evoth.*

Twig — మేన్కొబ్బు. *ménkobbu.*

Twilight — నడుజామ. *naḍujáma.*

Twin — ఎమ్మొర్మొఖ్. *emmormokh.*

Twinkle — కణ్ణుకూట్స్బిని. *kaṇṇukúṭsbini.*

U.

Udder — మొర్ష్. *morsh,* మొఴ్. *mozh.*

Ulcer — పుణ్ణు. *puṇṇu.*

Ugly — ఆధ్హడి. *ád'hadi.*

Umbrella — క్వర్. *kwar.*

Uncertain — నెల్లిల్లె. *nellille.*

Uncle — ఎన్నేన్పెరుడ్. *ennénperud,* ఎన్నేన్కెరుడ్. *ennénkerud.*

Under — ఎర్క్. *erk.*

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Up	ಮೊಕ್.	*mok.*
Urine	ಉಚ್ಚೆ ನೀರ್.	*uchchenír.*
Understand	ಅರ್ದ್ಥ್ಬಿನಿ.	*ardthbini.*
Unjust	ನಾಯಂ ಯಿಲ್ಲಾದೆ.	*náyam yilláde.*
Urge	ಬಲಂಗಡೆರ್ಷ್ಬಿನಿ.	*balamgaḍershbini.*

V.

Vagaband	ಪರದೇಸ್.	*paradés.*
Value, price	ಬೆಲ್ಲೆ.	*belle.*
Vegetable	ಸೊಪ್ಪು.	*soppu.*
Venereal	ಸೂಳಿ.	*súḷi.*
Vertex	ಮದ್ದ್ನೆರೆನ್.	*maddneren.*
Vial	ಪುಟ್ಠಿ.	*puṭṭ'hi.*
View	ನೋಟ್.	*nóṭ.*
Violence	ಬಲಂ.	*balam.*
Voice	ದನಿ.	*dani.*
Vomit	ತಾದ್ವೆರ್ಷ್ಬಿನಿ.	*tádvershbini.*
Village	ಹಟ್ಠಿ.	*haṭṭ'hi.*

W.

Wait	ಕಾತೆರ್ಷ್ಬಿನಿ.	*kátershbini.*
Walk	ನಡೆದ್ಸ್ಬಿನಿ.	*naḍedsbini.*
Wall	ಗೋಡಿ.	*góḍi.*
Want, famine.	ಪಂಜಂ.	*panjam.*
Want, I	ಯೆನಗ್ ಬೇಕದೆ.	*yenag békade.*

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War — జగళ. *jagaḷa.*

Warm, I — బెంద్వెర్ష్బిని. *bendwérshbini.*

Wart — జట్ఠు. *jaṭṭ'hu.*

Wash — తువత్స్బిని. *tuvatsbini,* అర్ష్బిని. *arshbini.*

Waste — కెట్ఠ్సిహాక్స్బిని. *keṭṭ'hsiháksbini.*

Water — నీర్. *nír.*

Wax — మెష్క్. *meshk.*

Way — ఆళ్దార్. *áḷdár.*

Weak — అల్పెర్ష్బిని. *alpershbini.*

Wear — బూత్స్బిని. *bútsbini.*

Wealth — ఆస్తి. *ásti,* బథ్క్. *bathk.*

Wed — మెథగెర్ష్బిని. *methagershbini.*

Week — ఎట్ఠ్నాళ్. *eṭṭ'hnáḷ.*

Weigh — తూక్స్బిని. *túksbini.*

Well — బావి. *bávi.*

Well, good — ఉళితు. *uḷitu.*

West — మొక్. *mok.*

When — ఎత్వన్. *etvan.*

What — ఏనుం. *énum.*

Wet — నాడ్. *nád.*

Wheat — గోదుబి. *gódubi.*

Whistle, I — నెల్డ్థ్బిని. *neldthbini.*

Where — యెల్లి. *yelli.*

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Whip	చబక్. *chabak.*
Whiskers	మొయి. *moyi.*
White	బెళ్ప్. *beḷp.*
Who	ఆరియొ. *áriyó.*
Whore	జ్ఖూవి. *ckzhúvi.*
Wide	అగలు. *agalu.*
Widow	ముద్దెగిత్తి. *muddegitti.*
Widower	బరుడ. *baruḍa.*
Wife	కుయిగ్యొ. *kuyigyó,* అకుఖ్. *akukh.*
Willow	బఖ్మెన్. *bakhmén.*
Wind	కాటు. *kátu.*
Wipe	వర్ర్ద్థ్బిని. *varrdthbini.*
Wilderness	అర్గాడ్. *argáḍ.*
Wing	డెర్కి. *derki.*
Wink, I	కైఎష్ట్స్బిని. *kaieshtsbini.*
Witchcraft	పిలి; *pili,* సూని. *súni.*
Wish	ఆసె. *áse.*
With	నెర. *nera.*
Wither	వొనగెర్ష్బిని. *vonagershbini.*
Without	పొర్ర్ముట్. *porrmut.*
Within	ఉళ్ట్. *uḷt.*
Witness	సాకిచి. *sákichi.*

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Woman	కుఖ్. *kukh.*
Wood, forest	క్వార్ష్. *kwársh.*
Word	మాటు. *mátu.*
Work, I	కెల్లస్ గెర్ష్బిని. *kellasgershbini.*
Worm	పు ఫ్. *puf.*

Y.

Yard ఎమ్మగై. *emmagai,* ½ yard వొమ్మగై. *vommagai.*

Yawn	ఆబిట్ట్హ్స్బిని. *ábiṭṭ'hsbini.*
Year	కు వర్. *ḱuvar,* ఉ వఴార్. *uvazhár.*
Yes	హా. *há,* అత్తనాది. *attanádi.*
Yesterday	ఎన్నేర్. *ennér.*
Yield	వొబ్బిస్బిని. *vobbisbini.*
Yoke	నొఖన్. *nokhun.*
Young	మొఖ్ వర్షాళ్. *mokhvarshál̤.*

The verbs I have always written in the 1st person singular, because with several verbs I was not quite sure how far the radix extends.

As the Todas very often do not pronounce their words distinctly enough for a foreigner, it is possible that I may have exchanged the following letters for each other ఱ (ற)—*ṛṛ* for ర (ர)—*r*, ఴ (ழ)—*zh* for స్—*s* or ష్—*sh*, త—*t* for ద—*d* etc.

The more accurate I wish to be, the more difficult I find it to reduce the Toda language to writing.

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II. *A Memoir on the Ancient Reservoirs at Aden. By* LIEUT. R. L. PLAYFAIR, *of the Madras Artillery, Assistant Political Resident, Aden.*

THE expedient of constructing reservoirs in which to collect and store rain water, has prevailed in Arabia from the remotest antiquity, these are generally found in localities devoid of perennial springs, and dependant on the winter rains for a supply of water during the summer months; or in those insular positions which are cut off from the copious torrents, that descending from the mountains, fertilize the Tehâma of Yemen, and in the beds of which a constant supply of pure water may be procured by digging, a few feet below the surface of the soil.

The first and most remarkable instance on record is the great dam of Máreb, attributed by Aboo'l-Féda to Abd-esh-Shems surnamed Sâba, who founded the city from him named Sâba, and afterwards Máreb.

Other historians however assign to it an earlier origin, and it is related that Lokman, king of that remnant of the Adites who had renounced idolatry at the preaching of the Prophet Húd, and who are usually called the second Adites, took up his abode about B. C. 1750 in the region of Sâba.

This country was frequently ravaged by impetuous mountain torrents, while at other times it was parched for want of a sufficient supply of water, in order therefore to remedy these evils, he conceived the idea of building a dam across the gorge of a valley contained between two mountains, which he thus converted into a vast reservoir of five leagues in length, for the reception of the rain water descending from the hills.

The dam was built of cut stone, secured by iron or copper cramps, and cemented with bitumen, forming a prodigious mass of masonry, 300 cubits broad, 120 feet high, and two miles in length; it was provided with thirty sluices, through which the water was convey-

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ed into canals for the irrigation of the fields and gardens of Máreb, and by means of which, that city became what Pliny styled it, "the mistress of cities, and the diadem on the brow of the universe."

The dyke having somewhat suffered from the lapse of time, was repaired and consolidated by the Himyarite Queen Balkís, about the commencement of the Christian Era, and in her time it was deemed too strong ever to be destroyed.

That catastrophe did however at length take place, the dam which had stood for 1700 years, yielded to the pressure of water from within, and gave way, deluging the country far and wide, and carrying away the whole city with the neighbouring towns and people; and thus the prosperity of Máreb was destroyed.

This event took place about A. D. 120, and is famous in Arabian History as the "*Sail-el-Arim*" or "*rush of water from the reservoir*" by which name it is mentioned in the Korán.

M. Arnaud, a French traveller, reached Máreb in 1843 after a difficult and arduous journey, and succeeded in obtaining measurements for a plan of this famous dyke, which I believe he has since published; according to his account, it was situated between two hills named Balak, which, when joined, by the wall, formed the reservoir; the enclosed space is of such extent, that a shout from one end, could not be heard from the other, and the massive masonry, though rent here and there, still attests the original solidity of the work.

This doubtless suggested similar reservoirs in other parts of Arabia and the neighbouring coasts of Africa, which have usually been subject to it, and with the spread of the Kaliphate Westwards, the idea was introduced into Spain and other Mahomedan conquests.

The Reverend Mr. Stern, who succeeded in reaching Sanaa in September of this year, (1856) informed me that, during the whole of the route between that city and Menákhir, near Jebel Harraz, large and beautifully constructed cisterns occur, these during his visit were perfectly water-tight and contained a considerable supply of water, though partly filled up and choked with long rank grass.

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This traveller did not observe any in the Teháma, probably they are not required there, as the softer nature of the soil admits of considerable absorption, whereby a sufficient supply of water can be obtained from wells.

Lieutenant Burton in his "First footsteps in Eastern Africa" describes several tanks and water-courses on the Island of Saad-ed-dín near Zailah, one of them is a work of some art, it consists of a long sunken vault with a pointed arch projecting a few feet above the surface of the ground, the exterior is of rough stone, and the inside is carefully plastered with fine chunam.

Mr. Salt describes a connected set of four reservoirs on the Island of Kútto, in the bay of Amphila, they are excavated in the form of a cross, each being thirty feet long, nine broad, and seven deep, lined with chunam, and together capable of containing about 120,000 gallons of water; a tradition current amongst the natives ascribes their construction to the Persians, who conquered Yemen from the Abyssinians early in the seventh century, and for some time held unrivalled possession of the commerce of the Red Sea.

The same traveller, in his previous voyage with Lord Valentia, discovered a number of similar cisterns in the Island of Dhalák near Massowah, but of larger dimensions, the natives have a similar tradition regarding their construction to that current at Kútto, they asserted that the original number was 316, but admitted that they had never seen more than thirteen or fourteen.

The Island of Massowah also contains a number of oblong tanks, some of which are of great extent, and are chiefly private property, the scanty supply of rain water which they contain, is kept under lock and key.

Captain Haines, in his Memoirs on the South coast of Arabia, mentions the discovery of several tanks amongst the ruins of Hosn Ghoráb, the cement of which was as hard as the solid rock, local tradition assigned the peopling of that district, and the construction of the buildings there, to a race whom he calls Koum Harmás, probably *Koum Hormuz* "people of Hormuz," or Persians, thus confirming, in a remarkable manner, the traditions recorded by

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Lord Valentia and Mr. Salt, regarding the origin of the tanks on the Islands of Dhalák and Kútto.

Colonel Chesney mentions the fact of similar reservoirs undoubtedly of Saracenic origin, existing in Granada, Cordova, Seville and Gibraltar, these, from the perfection of their coating, continue to be water-tight, though some of them, as those under the Castle of Gibraltar, must have been in use upwards of seven centuries.

Two very remarkable cisterns exist in the ancient fortress on the summit of mount Agatha, in the Termino of Mercadel, in the Island of Minorca, the Moorish origin of which is attested by an Arabic inscription. These differ from those of Gibraltar, by being raised structures instead of excavations, and they are of much greater dimensions, being capable of containing 2173 tuns, or upwards of half a million gallons of water.

Numerous other instances might be cited, but with the single exception of the great dam of Máreb, none equal the magnificent series lately discovered at Aden, which, when restored, will probably contain not less than twenty or thirty million imperial gallons.

There is no certain record of the construction of the Aden reservoirs, and the natives of the place have no tradition regarding them in which they place much confidence. It is probable that some are of great antiquity, and that others were built as the necessity for them arose, or as the piety of individuals prompted them to construct some work, by which a great public benefit might be conferred upon their city. This latter supposition is supported by the fact, that under the domed entrance to one of them lately restored, a tomb, probably that of the founder, was discovered, and I have been given to understand that an inscription was removed from this tank by the late Surgeon Malcolmson, which probably would have afforded some clue to its history.

My impression is, that the construction of these reservoirs was first commenced after the second Persian invasion of Yemen, about A. D. 600, but of this fact we have no authentic record.

It is related by the Imám Alí ibn Hoosain-el-Khuzrají, that Melek-el-Mansoor Taj-ed-Dín Abd-el-Waháb ibn Táhir, sovereign

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of Yemen, between his accession to the throne in A. D. 1472, and the great famine which decimated Yemen in A. D. 1502, built many religious edifices throughout the country, especially in Aden, amongst others, numerous reservoirs, aqueducts, &c. the most important of which was the aqueduct to convey the water of Bír Amhait into Aden.

There is also a tradition in Aden, that about A. H. 906 (A. D. 1500,) the Governor persevered in digging wells for sweet water, and being successful, the reservoirs were permitted to fall to ruins, or to be filled up with the *debris* washed down from the hills.

Probably the water obtained from these wells, and from the Bír Amhait, sufficed for the supply of the place, which had begun to decline in consequence of the Indian traffic having been diverted from its ancient channel, by the discovery of the route to Europe round the Cape of Good Hope, and the preservation and repair of the reservoirs became no longer a matter of pressing necessity.

The aqueduct above mentioned appears not always to have sufficed for the supply of Aden, (which continued, as late as the seventeenth century, to have a population of 30,000 souls,) as, in a Latin tract written by Resendius bearing date A. D. 1530 and entitled "Epitome Rerum Gestarum in Indiâ a Lusitanis," he remarks, "that the water was daily brought in on camels, which on some days amounted to 1,500 or 1,600 and even 2,000, and that if they came in the day time, the water was taken to the city, but if in the evening, it was deposited in a *large cistern near the water house*."

The above extract is quoted by Mr. Salt, to prove that the aqueduct from Bír Amhait did not exist in the time of Resendius, but I think this conclusion hastily formed, as there is no reason to doubt the fact that it was constructed by Abd-el-Wahâb ibn Táhir, and that the "*cistern near the water house*" was the large reservoir built at the Aden termination of the aqueduct, to receive the water of Bír Amhait.

This aqueduct and reservoir were in use when Aden was visited by a deputation of French merchants of St. Malo under M. de Merveille in A. D. 1708, and the remains of both were seen and de-

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scribed by Mr. Salt himself in 1809, who describes the latter as being near a *Beit-el-ma* or *water house*, which formed a shelter for the natives who brought supplies into the town.

The remains of the aqueduct still exist, and those of the reservoir were only destroyed by our Engineers a few years ago, when constructing the Isthmus defences.

If then the aqueduct was not built during the visit of Resendius the object of the cistern on the Isthmus, in a position where it could never be filled by rain water, is not apparent, the more probable supposition is that water was brought in on camels during some temporary stoppage of the aqueduct, and that the local tradition which assigns the discontinuance of the use of the reservoirs for the reception of rain water to this period, is correct.

The following is the description given by Mr. Salt of the tanks within the crater of Aden :—" Amongst the ruins some fine remains of ancient splendour are to be met with, but these only serve to cast a darker shade over the desolation of the scene. The most remarkable of these remains consists of a line of cisterns situated on the N. W. side of the town, three of which are fully 80 feet square and proportionably deep, all excavated out of the solid rock, and lined with a thick coat of fine stucco, which externally bears a strong resemblance to marble ; a broad aqueduct may still be traced which formerly conducted the water to these cisterns, from a deep ravine in the mountain above ; higher up is another still entire, which at the time we visited it *(November)* was partly filled with water, in front of it, extends a handsome terrace formerly covered with stucco, and behind it rise some immense masses of granite, which being in some parts perpendicular, and in others overhanging it, formed during the hot weather a most delightful retreat.

Some Arab children who followed us in our excursions were highly pleased when we arrived at the spot, and plunging headlong into the water, much amused us by their sportive tricks."

When Captain Haines visited Aden in 1835 several of the reservoirs appear still to have been in a tolerable state of preservation ; besides the hanging tanks, or those built high upon the sides of the

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hills, several large ones were to be traced round the town, but since the occupation of Aden by the British, no steps having, until lately, been taken to repair or to preserve them from further destruction, they became entirely filled up with stones and soil washed down by the rains, the people of the town were permitted to carry away the stones for building purposes, and with the exception of the hanging tanks above mentioned, which could not easily be destroyed or concealed, all trace of them was lost, save where here and there a fragment of chunam projecting above the ground, indicated the supposed situation of a reservoir, believed to be ruined beyond the possibility of repair.

About three years ago, Government sanctioned the repair of three of the tanks which appeared in the best state of preservation, and the result was so satisfactory that the Political Resident applied for, and obtained permission to restore the remainder. The task of superintending the work was entrusted to me, and I at first employed the convicts, and such free labor as the limited surplus of the Municipal funds, aided by the sale of the rain water collected, enabled me to command, permission was subsequently obtained for appropriating the quit rent on building grants, amounting to about eight hundred Rupees per annum, for this purpose.

At this time no idea was entertained that the tanks were so numerous and so vast as they subsequently proved to be, and it was believed that they could all be restored in the manner above described, without entailing any expense on the state: as the work progressed, and as day by day new discoveries were made, the impossibility of this became manifest, and Government was pleased to sanction the employment of the public funds to ensure the work being completed expeditiously and well.

At present much has been done and at a comparatively trifling expense, which will be more than repaid by the first heavy fall of rain, but much more remains to be done, and it will yet be years ere all the reservoirs are put in a serviceable condition.

I despair of being able, without a plan, to give such a description as will enable any one who has not seen, thoroughly to understand them.

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A glance at the map of Aden will show, that the range of hills which forms the boundary of the crater, is nearly circular, on the outer or Western side, the hills are very precipitous and the rain water descending therefrom is carried rapidly to the sea by means of a number of long narrow valleys separate from each other.

On the inner, or Eastern side, the hills are quite as abrupt, but the descent is broken by a large table land occurring about midway between the summit and the sea level, which occupies about one-fourth of the entire superficies of the Peninsula.

This plateau is intersected by numerous deep ravines, nearly all converging from the Shumshum range into the Tawela valley, which thus receives about a quarter of the drainage of the Peninsula.

The steepness of the ravines, the hardness of the rocks and the scarcity of soil on them, all combine to prevent any great amount of absorption, and thus a very moderate fall of rain suffices to send a stupendous torrent of water down the valley, which, ere it reaches the sea, not unfrequently attains the proportions of an unfordable river.

The damage done by this torrent has frequently been considerable, during my residence in Aden I have seen kutcha houses, furniture, animals, and even human beings carried with irresistible velocity into the sea, and during a fall of rain which occurred at midnight on the 28th December 1842, so great was the rush of water that upwards of two hundred animals, were carried away, and nine men were missing in the morning, only three of whose bodies were ever found.

Rain to this extent is exceptional in Aden, but few years pass, during which many thousand tuns of water are not lost from want of means to retain it.

Our predecessors were more provident as the gigantic reservoirs, which occur chiefly in and near the main water-course, the Tawela valley, attest.

Most travellers have erroneously described them as excavated out of the solid rock, but I am not aware of any such. Those under

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the foot of the hills are generally built at a re-entering angle of the rock, which promises a copious flow of water, here the soil has been carefully cleared away and a salient angle or curve of masonry built across it, while every feature of the adjacent rocks has been taken advantage of, and connected by small aqueducts, to ensure no water being lost.

The overflow of one tank is conducted into another, and thus I believe that a complete chain existed into the very centre of the town, where small tanks which could not otherwise be filled, are being daily discovered.

Their construction is extremely fantastic, the only principle which seems to have been adhered to, is the avoidance of straight lines, and the wisdom of this has been proved in the recent excavations, as in almost every instance where a straight line has existed, it has been forced in by the rush of water without it.

They are generally of stone and mud masonry, roughly plastered on the outside, and beautifully coated in the interior with chunam; flights of steps, gradients, platforms, &c. are heaped together and give an exceedingly grotesque appearance to the whole: each large tank has a smaller one in front of it, built for the purpose of retaining all earth and stones carried down by the torrent, and permitting a pure stream of water to flow into the reservoir beyond.

As before mentioned, the majority of the tanks are in and near the Tawela valley, which intersects and receives the drainage of the large table land under the Shumshum range. This valley is 700 feet in length from the point where it leaves the table land, to its actual junction with the level plain of the crater. The hills throughout its entire length are perpendicular, and at the head of the valley they meet, leaving barely sufficient room for one man to pass. The valley then gradually opens out, and at the gorge, it is one hundred and fifty feet in breadth, the hills then circling round to the right and left, form part of the walls of the crater of Aden.

Appendix A is a tabular statement of the various tanks which, together with the aqueducts leading to them, have been thoroughly repaired and are now ready to receive water.

No. 1 is at the top of the valley just described, and is formed by a wall drawn across it, connecting the hills on either side, precise-

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ly similar to, but on a much smaller scale than, the great dam of Máreb.

The rocks within it have been coated with chunam to prevent leakage, above it is another large but natural tank which retains water during the greater part of the year, this was formerly inaccessible, but steps have now been cut, and hand rails and iron stanchions inserted in the rock, to facilitate communication with it.

No. 2 is situated lower down the valley, on the west or left side, and at some distance from No. 1, the intermediate space being occupied by the Tawela well; formerly no communication existed between them, but a broad paved aqueduct has now been constructed to answer the double purpose of preserving the water which may overflow from No. 1, and the drainage of the intermediate rocks.

No. 3 is immediately adjoining No. 2 and connected with it by means of a sluice near the top of the wall.

No. 4 is connected with No. 3 in the same manner, and its overflow is conducted into a large aqueduct thirteen feet in breadth, which runs down the centre of the valley, round the Bír Khalád into No. 8½.

No. 5 is situated on the east or right hand side of the valley, near No. 1, and opposite No. 3, it is extremely fantastic in construction, and has two deep wells in the centre, one of which is thirty-five feet in depth.

No. 6 is connected with the preceding by means of a slit in the rock which conveys the water into it.

No. 7 a tank of very similar construction, the overflow of which is carried by a branch aqueduct across the valley, into the main aqueduct, in which is situated the small tank No. 8½.

No. 8½ is, as above said, a small tank in the main aqueduct, built for the purpose of preventing the soil and stones washed down by the rain from falling into, and injuring the large one beyond it (No. 8): here the overflow of all the other tanks above it, meet so that no water descending from the hills can by any possibility escape, it must all flow into the main channel, at some point of its course.

No. 8 is a large reservoir through which the main aqueduct

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flows; it was very much destroyed, one wall having been forced in, either from the pressure of water from without, after the tanks and aqueducts above it became ruins, or by the water finding its way inside the masonry and sapping its foundations. It has however been repaired, and I am sanguine that it will prove water-tight.

Thus far only the series is complete, beyond, the main aqueduct has not been finished, though it is in course of construction, and the other tanks, which are finished, have not been united.

One of the most remarkable is No. 11, which is a double tank situated below a deep rift in the hill, down which a great volume of water flows, but as if to make sure of its being filled, the drainage of the hill side behind it, is conveyed into it by an aqueduct leading through a small hole in the rock, not larger than a man's head. The entrance to this tank was originally domed, and contained an inscription which has been removed, the dome has been restored.

The other tanks which have been restored, require no notice.

Appendix B is a statement of all the remaining reservoirs which have been discovered, some of them are cleared out and nearly completed, others are in course of restoration, the rest have not been commenced: of these immeasurably the finest is that marked I. It is nearly a cylinder of one hundred and forty-eight feet in diameter but the depth has not yet been ascertained, about twenty-four feet have been cleared out, but the bottom has not been reached: into this reservoir, the overflow of all the tanks from No. 1 to 10, in table A and from A to H in Table B and probably several others, will meet.

It may be imagined that in so arid a spot as Aden, so many tanks are useless and can never be filled, but I have known many falls of rain during my residence here, which would have filled them all, and many more had they existed.

I regret that I am unable to delay the printing of this memoir, until a plentiful fall of rain, which may be expected about this season, shall have tested their value.

But whether they *all* prove water-tight or no, it is hardly possible to over estimate the value of these reservoirs in a place like Aden, which with a population of 25,000 souls, has a daily supply of sweet water not exceeding 15,000 gallons.

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Water containing three parts of saline matter in every 2000 is usually considered unfit for domestic purposes, but in Aden, at least 15,000 of the inhabitants are compelled to drink water containing as much as from five to ten parts in 2000. It cannot therefore be doubted that the large increase to the water supply which these cisterns must afford, will prove an inestimable blessing which would be cheaply purchased at almost any price.

Probably in the most unfavorable season not less than 6,000,000 gallons will be collected, this at once doubles the annual supply, and reckoning the value of this increase at the minimum rate at which water is ever sold in Aden, and at which it has a ready sale, viz., one Rupee per hundred gallons, we have an annual revenue of Rupees 60,000. Thus in a single year, and one far below the average, a greater sum of money will be collected than is likely to be required for the restoration of all the tanks.

I cannot refrain from quoting an extract of a letter addressed to the Right Honorable Lord Elphinstone, under date the 27th of July 1856, by one who saw the tanks on his route to England, and which was communicated to the Political Resident by Government.

"I was much interested in the tanks which Brigadier Coghlan showed me; a short time ago they were as completely buried as Herculaneum, and we passed over some, which being filled up to the brim with rubbish, have less the appearance of being what they are than Pompeii must have had before it was excavated. Six of these have been cleared out and are quite ready to catch any drop of water which falls, they are admirable and substantial works, most beautifully chunamed, and most fantastic in their shapes, with all sorts of queer steps: when they are all cleared out, Aden will be quite independent of exterior sources for its water supply."

Table C is an abstract statement of the receipts and expenditure on account of the restoration of the reservoirs, from the commencement of the work in 1855 to the end of 1856.

The total amount is Rupees 11,543-0-3 of which only Rupees 6,500 has been paid by the State, the balance having been collected from local sources.

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A reference to Table A will show that tanks of the aggregate capacity of 3,538,715 imperial gallons have been completed at an expenditure of 11,543 Rupees, in other words, that a permanent and tolerably reliable water supply has been secured to Aden, at the rate of five annas and three pies *of original outlay*, for a constant supply of one hundred imperial gallons *per annum*. The best comment I can offer on this is the fact, that at present, Government is paying to the Haswah water contractor, one Rupee and twelve annas for every hundred gallons of water supplied by him to the vessels of war in the harbour and the various public departments located outside the Main Pass, and the merchant vessels are paying nearly double that price for worse water.

It is much to be regretted that no regular register of the Pluviometer has ever been kept in Aden; but an imperfect series of memoranda exists in the records of the Jail, from which Table D has been framed.

The falls numbered 5 and 8 and the two unrecorded, in September 1853 and March 1854, would have sufficed to fill all the reservoirs in the Peninsula, and those numbered 1,12 and 18 would probably have given not less than 6,000,000 gallons each. Thus in the course of five years the reservoirs would have been entirely filled four times, and about twenty million gallons of water would have been collected in addition at intermediate periods, or calculating the entire contents of the reservoirs, when all shall have been cleaned out and repaired, at twenty million gallons, we may expect to have an annual supply of twenty million gallons, in addition to that afforded by the wells.

This of course may be multiplied indefinitely by constructing new reservoirs at Steamer Point and other localities where they do not at present exist.

The above is of course merely conjectural, the tanks have never been filled, and it is impossible to frame any calculations regarding them, with even approximate accuracy, but I trust that sufficient has been shown, to remove any doubts as to the advisability of carrying on the work, and restoring all that have been discovered, the more so as the expense cannot be very considerable.

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TABLE A.

Tabular statement of the Tanks already completed.

Number.	Extreme dimensions, in feet. Length.	Breadth.	Depth.	Capacity in Imperial Gallons.	REMARKS.
1	150	60	40	1,500,000	At the head of Tawela Valley.
2	33	20	28	54,328	On West side of valley, next to, and connected with, No. 1, by an aqueduct.
3	30	34	21	29,875	On West side of valley next to, and connected with, No. 2.
4	45	46	27	188,693	On West side of valley, next to, and connected with, No. 3.
5	74	30	20	93,000	On East side of valley, next to, No. 1.
6	41	26	25	58,000	On East side of valley, next to, and connected with, No. 5.
7	75	30	23	95,987	On East side of valley, next to, and connected with, No. 6.
8½	26	16	9	22,464	On West side of valley, small tank to prevent stones &c., falling into No. 8, connected by an aqueduct with No. 4 and by another crossing the valley with 7.
8	80	70	26	508,940	On West side of valley, connected with No. 8½.
9	39	29	14	52,500	On West side of valley.
10	43	29	17	75,181	Do. connected with No. 9.
11	99	59	28	328,000	Outside gorge of valley on West side.
12	33	18	15	45,000	Outside valley, on the East side, above Parsee cemetry.
13	74	70	33	486,750	A detached tank, on the Munsoorie heights above Church yard.
Total capacity..				3,538,715	

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TABLE B.

Tabular Statement of Tanks, under repair, including all which have been discovered, but not yet excavated.

Designation.	Probable capacity in Imperial Gallons.	REMARKS.
A	15,250	Near Bir Khalàd in Tawela valley.
B	54,315	Do. do. do.
C	42,000	Two small tanks joined together, at S E. corner of Tawela valley cleared out, but not repaired.
D	35,000	Next to C.—cleared out but not repaired.
E	22,000	Next to D. Do.
F	32,000	Next to E. Do.
G	600,000	Behind Parsee cemetry, about half cleared out.
H	202,860	Tank in front of I. to catch the stone &c. cleared out, but not repaired.
I	4,000,000	The largest yet discovered, situated just outside of Tawela valley, into which the overflow of all the above tanks, and No. 1 to 10, in Table A. meet;—about half cleared out.
J	1,500,000	Near I. and leading into it, not cleared out, but outline traced.
K	38,250	Small tank to prevent stones falling into J, cleared, out, but not repaired.
L	300,000	Behind Parsee gardens, supposed to be ruined beyond the possibility of repair.
M	Unknown.	Tank in which Parsee garden has been made.
N	Unknown.	Above Jew's burying ground.
O	70,000	Above Sebundee Lines.

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TABLE. B. (*continued*)

Designation.	Probable capacity in Imperial Gallons.	Remarks.
P	8,000	Near O.
Q	Unknown.	Large tank, much destroyed, near furnaces.
R	260,000	In good condition, above furnaces.
S	Unknown.	Small tank, quite buried, below R.
T	Unknown.	Large tank, quite buried, below S. will probably contain upwards of one million gallons.
U	340,000	Large tank near R. in good condition, aqueducts destroyed.
V	116,000	In good order, high upon the hill above U. almost inaccessible.
W	190,000	Next U. much destroyed.
X	320,000	Two small tanks be'ow W. much destroyed.
Y	320,300	In corner of hill, near No. 11 of Table A. in good order.
Z	84,000	A large fissure in the rock, walled in, above Q.
a	Unknown.	Above Engineers' store yard.
b	Unknown.	Above lines, 18th Regiment N. I.
c	Unknown.	In lines of 18th Regiment N. I. quite buried.
d	Unknown.	Three tanks above Mess 18th Regimnent N. I.
e	Unknown.	Large tank, in Hydroos valley.
f	Unknown.	Small tank, below Hydroos bund.
g	Unknown.	In the town, near house of Abdulla Mater.
h	Unknown.	Do. near Sebundee lines.
i	10,800	Do. behind town Police station.
z	25,000	At the Hejaff, in good order.
		N. B. Several on Seerah island, not searched for.

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Table C.

Abstract statement of the receipts and disbursements on account of repairing the ancient Reservoirs at Aden, from the commencement of the work in 1855, till the end of 1856.

Cr.	Rs.	A.	P.	Rs.	A.	P.
1855.						
Realized by sale of water collected in reservoirs.............	40	9	0			
Quit Rent for 1855, collected in this year...................	501	14	4			
Paid from Municipal Fund......	374	0	2	916	7	6
Estimated value of the labor of 558 convicts at two annas each......................	69	12	0	69	12	0
1856.						
Realized by sale of water collected in reservoirs..............	692	15	0			
Quit Rent for 1855 collected in this year..................	299	15	8			
Quit Rent for 1856..............	822	1	3			
Government grant in aid of the work.......................	6,500	0	0			
Paid by Municipal Fund.......	2,143	12	10	10,458	12	9
Estimated value of labor of 776 convicts at 2 annas each	97	0	0	97	0	0
	Total Rupees.			11,542	0	3

Dr.	Rs.	A.	P.	Rs.	A.	P.
1855.						
Labor and material expended during the year...	916	7	6	916	7	6
Estimated cost of the labor of 558 convicts at 2 annas each.	69	12	0	69	12	0
1856.						
Labor and material expended during the year	10,388	12	9			
Compensation paid to the owners of buildings for their removal	70	0	0	10,458	12	9
Estimated cost of the labor of 776 convicts at 2 annas each ..	97	0	0	97	0	0
	Total Rupees			11,542	0	3

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TABLE D.

Register kept in the Aden Jail, of the Rain which has fallen between the 12th of December 1851 and the end of December 1856.

Number.	Year.	Day.	Month.	Quantity in Inches.	Total during the year.	Remarks.
1	1851	12	December.	1·50		No record previous to this date.
2	1852	3	January.	·50		
3	,,	22	,,	·25		
4	,,	28	,,	5·50	6·25	A very heavy fall occurred in September 1853, which is not recorded.
5	1853	6	December.	·25		
6	,,	11	,,	·50	·75	
7	1854	11	January.	·24		
8	,,	12	,,	3·72		
9	,,	13	,,	·04		A fall of about five inches took place in the beginning of March 1854, which is not recorded.
10	,,	6	May.	·25		
11	,,	25	October.	·17		
12	,,	26	,,	1·88		
13	,,	5	December.	·10		
14	,,	7	,,	·20		
15	,,	28	,,	·05	6·65	
16	1855	2	January.	·20		
17	,,	9	,,	·30		
18	,,	10	,,	1·30		
19	,,	11	,,	·24		
20	,,	12	,,	·10		
21	,,	13	February.	·08		
22	,,	21	August.	·48	2·70	
23	1856	11	January.	·40		
24	,,	22	,,	·70		
25	,,	23	,,	·15		
26	,,	11	September.	·13		
27	,,	12	,,	·08	1·46	

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III. *The Tamil Epic Chintamani. By the* REV. P. PERCIVAL.

When the despatch of the Honorable the Court of Directors on their scheme of education was promulgated a year and a half ago, through the vernacular periodical press, its provisions were looked upon by intelligent natives, generally, as a beautiful theory never to be followed by any practical result. It was, indeed, believed, that so much of the despatch as related to English, might, for official purposes, be carried out; but not the most sanguine of my acquaintances among the natives had any belief in that which related to the vernacular languages. Since however a beginning has been made, and measures adopted for realizing the intentions of the Honorable Court, it may easily be conceived how agreeably the friends of education are surprized. The appointment of a Director of Public Instruction, the actual operations of inspection, the Establishment of a Normal School under a competent and zealous Principal, are among the facts serving to assure the native mind that Government is in earnest in the matter of public education. The Director has lately put forth a Code of Instructions for the Head Masters of Talook Schools which has created in many the greatest satisfaction. In that carefully prepared document, it is, in the very first paragraph, stated, that in the Talook Schools the instruction, the matter taught, is to be conveyed through a vernacular medium; when introduced, "English is to be studied only as a language." When the pupil has attained to a fixed standard in the vernacular, he will be permitted to begin the study of English; and not before. These facts are sufficient to show that public instruction is to be largely provided for, and that the vernacular languages will be made the vehicles of useful knowledge to the masses of the population. That the native mind is in any degree aroused by the facts occurring around us is matter of thankfulness. These auspicious prospects are, however, I regret to say, not unattended by much of a discouraging character; the native himself is likely to prove the greatest obstacle in the way of progress as regards vernacular instruction. And I

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do not entertain a doubt that, unless Government adopt measures to counteract certain tendencies in the native mind, the machinery it is now forming with so much zeal, ability and expense, will be in great measure inoperative. The native, arguing on palpable facts, maintains that it is not vernacular attainment that confers office and emolument, but a knowledge of English; and consistently enough he is disposed to devote all his energies to the latter. The remedy is, however, in the hands of Government. Let it be promulgated, by Government that in all cases a candidate for public employment from the peon upwards, must pass a graduated examination in order to test his knowledge of his own language; or present a certificate, signed by competent authority, to show that the required standard has been attained: this, and this only, will secure the efficiency of the means adopted by Government, for promoting vernacular education.

It is in place here to refer to a valuable contribution to the study of the vernacular languages of Southern India in the form of a comparative Dravidian Grammar recently published in London by the Revd. Mr. Caldwell. The study of comparative Grammar as regards the Indo-European family of languages has made great progress in the west; and for some time past the Dravidian tongues have been matter of enquiry and investigation among oriental scholars in England and on the continent of Europe. One or two works have issued from the press in Europe in Tamil executed in the most beautiful style. All these facts conspire to persuade the inference that an era is opening for the development of the treasures bequeathed to the natives of Southern India by the talent and industry of former ages.

Under these circumstances it may be of some benefit to direct attention to some of those ancient works which, in Southern India, have, for so many centuries, been the admiration of indigenous scholars; and the patterns for guidance in the authorship of modern times. By thus pioneering the way no doubt needs be entertained as to the track being followed by a succession of adventurers who will do good service. Whilst the attention of Europeans is drawn to the ancient authors of the Dravidian race, and thereby much that

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is truly interesting and valuable disseminated in Europe, it must not be overlooked that in the country itself it is of the utmost consequence to the progress of sound scholarship and correct taste that the best authors be brought to light, and if possible, published, under proper editorial supervision and responsibility.

Much, it is admitted, that is found in the indigenous literature even of the best periods, is, like some portions of the works of Greece and Rome, unfit for general perusal. The works of real value should notwithstanding be published and rescued from oblivion. In the course of time they may be expurgated; objectionable sentiments and passages eliminated; thus separated from the vile, the precious would have an enduring value.

These general remarks are intended to introduce to more particular notice the Classical work entitled Chintamani.

It is the opinion of native scholars that the Epic Chintamani, which was composed by Terudèvar sometimes called Tiruttakkadèvar, was written about two thousand years ago; the author was a Jaina and resided at Mylapore, now a suburb of Madras: although this opinion may be incorrect, no doubt the work in question is very ancient; it was doubtless written several centuries ago. This celebrated work is one of the five classical productions which are regarded as undisputed authorities in all matters relating to Tamil philology.

The five works are Chintamani, Chillapadikaram, Valleiyapathi, Kundalakèsi, Manimèkalei.

The book under notice contains the heroic story of a King named Jìvaka; his history is also found in the Maha Purana, a work written in Sanscrit. This Purana belongs to the Jainas, and, of course, is not one of the celebrated eighteen.

The author of Chintamani is regarded by all Tamil Scholars, ancient and modern, as one of the most learned men that ever appeared. It is said that he was acquainted with Agatteyam and Tolkappeyam, the celebrated ancient Tamil Grammars; and that he was deeply read in all the best works then extant in the Sanscrit language, including the Sacred Vedas. The best writers in the Tamil language refer to this work in illustration of their forms of con-

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struction, and Grammarians quote this work as of undoubted authority.

Nacchenārkinneār of Madura, himself a man of great erudition, and a commentator on three parts of Tolkappeyam, the Cural, and Sillapadekaram, has also written notes on Chintamani. The comments of this author, on Chintamani and the other works, are regarded by the Tamil Literati as unquestionable authority. The commentary of this writer composed before he had examined the claims of the Jaina theology, was not at first received by that sect. He afterwards, however, revised his commentary, conforming it to their doctrinal peculiarities, and it was thenceforth received by them as a correct exposition of his author.

The Chintamani contains three thousand one hundred and forty-five tetrastichs, and it is divided into thirteen sections called Ilambakam.

1. The story of the hero Jìvaka commences with certain particulars relating to him prior to birth. When an infant, he was cherished by a Chitty, a merchant, who rescued him from the forest in which he was born; his mother having fled thither from the assassin who had slain the King her husband. This section called Namagal Ilambakam contains 408 verses.

2. The second section called Kovindiyar Ilambakam relates the early exploits of young Jìvaka. It appears that a gang of free-booters attacked the city in which he dwelt, plundered it, and carried away much property, driving before them, as they retired, the cattle belonging to the inhabitants. On this occasion the young hero distinguished himself by great bravery, pursued the plunderers, and rescued the spoils they had taken. In consequence of this deed of valour, a citizen named Pasukavalam was induced to give his daughter Kovindeyar in marriage to the son of the Chitty the foster father of Jìvaka. This section contains 84 stanzas.

3. The third section is named Kandarvatatteyar Ilambakam so called from the celebrated musician of the name of Tatteyar whose skill on the Indian lute or vina was almost unrivalled. She formed a resolution not to marry any one who did not surpass her in her

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favorite art. Jìvaka entered the list of competitors for the hand of Tattiyār, and his performance on the vìna gained him the prize he coveted. The history of these events contained in this section occupies 358 stanzas.

4. Gundmaleyar Ilambakam is the name of the fourth section which contains 315 stanzas. This section presents to the reader two young women of high family named respectively Gunamalei and Churamanjari who contended for superiority in regard to certain scented powders they possessed. These perfumes were so apparently identic in quality that it was impossible for ordinary persons to determine which was the better. Jìvaka decides the matter in favor of Kunamalei: she accepts him in marriage.

This section further relates some particulars respecting Sudarsana-jakshadèva who at that time appeared in the form of a dog, as the result of former deeds. He is metamorphosed by Jìvaka and attains his former position, on account of which he magnifies the powers of his deliverer.

This section also relates the incident of Churámanjari's escape from an Elephant which was killed by Jìvaka when about to attack her.

5. The fifth section is called Pathumeiyar Ilambakam. This section narrates the travels of Jìvaka in foreign lands. In the course of travel he meets Pathumei, a daughter of the king of Pallavam, when she was engaged in gathering flowers; as she was thus employed she was bitten by a venomous serpent: she is healed by Jìvaka, and in gratitude gives him her hand in marriage. The section contains 246 verses.

6. The sixth section is called Kemasariyar Ilambakam. This portion of the work narrates the visit of Jìvaka to Kshèmadèsam where he performs prodigies that gain for him the admiration of the king who bestowed on him his daughter in marriage: her name was Kshema Sundári. This section contains 145 verses.

7. The seventh section is called Kanakamaleyar Ilambakam. Here Jìvaka the hero of the poem is found in Susanadèsam.

The king suspends on high a mark, promising to give his daughter

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in marriage to the person who might succeed in displacing it by an arrow. Numerous royal personages compete for the coveted prize which was obtained by Jìvaka.

This section also relates the success of Jìvaka in obtaining in marriage for his foster father's son the daughter of the king of Saba, her name was Chisanti. This section contains 330 stanzas.

8. The eighth section is called Kimaleiyar Ilambakam, and contains 107 stanzas, Jìvaka taking his departure from Susanadèsam proceeds to Nannadu where he meets his mother in Tandakaraneyam, and salutes her. Having returned to his own city, he connects himself with a merchant, who, in consequence of the prosperity he enjoyed, and which he attributed to the auspices of Jìvaka, gives him his daughter in marriage ; her name was Vimalei.

9. This, the ninth section, containing 108 stanzas, relates the marriage of Jìvaka with Suramanjari, who, on the occasion of the dispute about the perfume, made a vow never to marry any other person.

10. The tenth section is called Manamagal Ilambakam. This section narrates the success of Jìvaka in competing for the hand of the daughter of his maternal uncle the king of Vidèkam. The king suspended a target, proclaiming that the prince who succeeded in hitting it should have his youngest daughter. Jìvaka is the successful party among many competitors and receives in marriage the fair damsel. The assassin and late minister of Jìvaka's father, who then reigned over the kingdom he had so unfairly obtained, hearing of the fame of the young man, suspects that he may prove to be the son of the deceased king. He therefore determines to seize him and put him to death ; and for this purpose proceeds to take him by violence. Jìvaka meets him, slays him, and ascends the throne of his ancestors. There are 358 stanzas in this section.

11. The eleventh section is named Purmagal Ilambakam and contains 51 stanzas. This section relates to the conquest by Jìvaka of the dominions of his father's assassin. This country was called 'Emangadèsam.

12. The twelfth section is called Ilakaneiyar Ilambakam and

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contains 221 verses. In this portion of the work the nuptials of Jìvaka and Ilakanei his maternal uncle's daughter are described.

13. The thirteenth section is called Mutti Ilambakam. The final portion of the poem describes the religious acts of Jìvaka and his wives, the partition of his dominions among his sons, and the renunciation of all secular pursuits and objects by himself and his devoted female associates.

This brief analysis of the work under notice, it is confessed, conveys but little to persuade the conviction of its superiority; the assumed facts of the Epic alone are here given. Though these may appear inadequate as the basis of a work for which so much is claimed, yet the work itself is so replete with credible incidents, so wrought up by the vigor of literary talent, so interspersed with remarks involving the keenest intropection into the grounds of human action, so rich in theological sentiment, so redolent of all the attractions of poetic genius, so full of circumstances evincing the condition of the arts and the customs of social life at the period of its composition; that the scholar, the poet, and the antiquary must be equally impressed in favor of the talent of the author, and the unrivalled power of the language in which he has embodied the splendid creations of his imagination.

Sometime ago an intimation was put forth in one of the weekly Journals to the effect that the work, whose analysis is here briefly sketched, would, if encouragement were afforded, be published. The idea has not been abandoned; but such would be the weight of the undertaking to a single individual, it can hardly be expected that any one will be bold enough to enter upon it. No doubt a considerable number of copies might be sold among the natives perhaps 500, and in time, it is possible, the publisher might recover the capital expended on the work.

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IV. *Entomological Papers, being descriptions of new Ceylon Coleoptera with such observations on their habits, ect., as appear in any way interesting.* By JOHN NIETNER, *Colombo Ceylon.*

No. IV.

Trib. BEMBIDIIDÆ.

Ochthephilus. n. g. N.

Corpus oblongum, subparallelum, valde depressum. Caput magnum antice trigonum; oculis magnis, ovatis, prominulis; collo forti. Mentum subquadrate emarginatum, lobis extus fortiter rotundatis, apice abrupte acuminatis, dente parvo acuminato. Ligula parva apice quadrate truncata, libera, paraglossis setiformibus marginem anteriorem longe superantibus. Palpi robusti art. 4° elongato, tenui, acuminato; maxillares art. 3° interne—, 2° externe incrassato; labiales art. 3° robusto externe incrassato, 2° parvo, cylindrico. Labrum parvum subtrigonum, antice emarginatum. Mandibulæ elongatæ, rectæ, trigonæ, apice arcuatæ, infra medium pluries dentatæ. Antennæ robustæ corporis med. fere attingentes, art. 1° et 11° mediocribus, subæqualibus, 2-4 et 5-10 inter se subæqualibus illis subcylindricis, his ovatis, Thorax subcordatus basi quadratus. Pedunculus brevis. Elytra apice rotundata. Pedes omnes simplices, subæquales, anteriores tibiis profunde excavatis, tarsis leviter contractis, art. 1-4 gradatim minoribus, art. 1° subcylindrico 2-4 subtrigonis, 5° sat magno, unguibus simplicibus.

43 *Ochthephilus Ceylanicus N.*

O. brunneo-testaceus, pedibus palpisque testaceis tenuiter pubescens; fronte profunde 2-sulcata; elytris obsolete striatis, in striis punctatis; long. corp. 1⅓ lin.

In fluminum ripis *Bembidiorum* more victitat.

This interesting little beetle might at first sight be mistaken for a *Læmophlœus*, the size, depressed form and color of which it has,

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however, the prominent eyes, cordate thorax— to say nothing of its habitat—remind one very soon of its real connexions. I do not think there can be any doubt that this insect forms a new and interesting addition to the BEMBIDIIDÆ. In fact the question, whether it belongs to this tribe or not depends, in my opinion, mainly upon the inferences drawn from the structure of the terminal joint of the palpi. It is true that this joint attains in *Ochthephilus* a degree of development unequalled amongst the BEMBIDIIDÆ; as, however, this development is not confined to the one particular joint alluded to, but affects the entire organ of which it forms a part, it can hardly be said to be a variation of much importance; and as, moreover, the general shape (independently of the elongation) and mode of insertion are the same as in the typical BEMBIDIIDÆ I have not hesitated to refer my n. g. to this tribe.

The head is as broad as the thorax and altogether of about the same size, it is strongly triangular from the eyes to the tip of the mandibles, the forehead is impressed with 2 deep longitudinal furrows, the eyes are large, rather oval and prominent, behind them the head is abruptly contracted into a thick neck. The antennæ are long and thick reaching nearly to the middle of the body, joints 1 and 11, 2 4 5-10 are subequal amongst themselves, 5-11 oval, 1-4 subcylindric. The labrum is small, rather triangular being narrowed at its base, it is emarginated in front with a slight angle in the middle emargination. The mandibles are long, straight triangular, bent at the tip only, dentated below the middle the one more so than the other. The maxillæ are thin and slender gently bent outwards at the base and inwards at the apex the outer lobe corresponding with the inner one in shape and strength. The palpi are robust, both the maxillary and labial ones have joint 4 elongated, thin and acuminated, in fact needle-shaped, firmly implanted in the preceding one not loosely hinged to it. The maxillary ones have joints 3 and 2 robust, the former swollen on the inner, the latter on the outer side. In the labial ones, joint 3 is still plumper than in the others, but differs in shape by being incrassated on the outer instead of the inner side, the 2nd joint being at the same time quite small and cylindric. The mentum is large

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and simple as above described. The ligula is small, oblong, very slightly narrowed and transversely cut away at the apex, the paraglossæ separate from its sides a little below the anterior corners; they are setiform and reach much beyond it. The whole organ is of membranaceous texture having, however, a more substantial centre or back. The thorax and elytra are simple and sufficiently described above. I may add that the former is divided by a longitudinal furrow and that both are furnished with a narrow margin at the sides. The scutellum is very small and the abdomen furnished with a short peduncle. The legs are weak, simple and nearly equal, the anterior tibiæ are deeply notched, the lower margin of the fourth tarsal joint of the same pair is furnished with a long thin spine, the apex of which fits in between the claws. I have been unable to discover any footbrushes or other sexual distinctions in the specimens before me, but it is not improbable that the tarsal spine just mentioned occurs only in one sex.

The habits of the insect are those of the *Bembidia* in whose society it lives upon the banks of rivers, taking like them readily to its wings. I have found it occasionally in considerable numbers upon the sandy banks of the Maha Oya in the neighbourhood of Negombo close to the edge of the water.

Trib. LEBIIDŒ *vel* PERICALIDŒ.

Creagris. n. g. N.

Corpus oblongum valde depressum. Caput magnum robustum; oculis mediocribus, ovatis, sat prominulis; collo brevi. Mentum forma ferri equini vel trifurcatum (hinc n. g. *Creagris*) lobis angustis, subparallelis, apice oblique truncatis, dente lobis parum breviore, tenui, acutissimo. Ligula magna, cornea, angulis anticis rotundatis, paraglossis connatis, marginem anteriorem non attingentibus. Palpi maxill. art. 4° claviformi, apice fortiter truncato; labiales art. 4 subelliptico, truncato. Labrum maximum, suborbiculatum, convexum. Mandibulæ parvæ, basi obsolete unidentatæ, labro obtectæ. Antennæ robustæ humeros attingentes, art. 1, 3 et 11 longitudine fere subæquali, mediocribus, 2° parvo, rotundato, 4-10 subæqualibus, cum 11° ovatis. Thorax parvus capite sesqui minor, transversus longitudine duplo fere latior,

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infra med. fortius angustatus, basi parum prolongatus. Pedunculus brevis. Elytra apicem versus leviter dilatata, apice fortiter subquadrate truncata. Pedes robusti, simplices, subæquales, ant. tibiis profunde excavatis, omnes tarsis brevibus art. 1° sequentium 2 fere longitudine, subcylindrico, 2 3 gradatim minoribus, magis minusve triangularibus, 4° magna, profunde bilobo, 5° mediocri, unguibus simplicibus, art. 4° subtus dense penicillato.

44. *Creagris labrosa N.*

C. picea, ore antennisque, coxis, trochanteribus femorum tibiarumque apice et tarsis brunneis; dense punctata obsoleteque pubescens; elytris striatis; long. corp. 4½ lin.

Specimen singulum prope Colombo nocte ad lumen cepi.

I consider this scarce and interesting insect to form a passage between the LEBIIDÆ and PERICALIDÆ, but am doubtful to which of these two tribes to refer it as, although it partakes of the characterristics of either, it is at the same time distinct from both. Distinguished in several respects, its most extraordinary character lies in the curious shape of the mentum. This is, however, easily described as large, of the shape of a *horseshoe* with a long, thin, very pointed tooth in the middle, the apical half of the sides (lobes) being at the same time gently dilated, the apex itself being obliquely cut away from the outer towards the inner side (the inner angle being the most advanced) and slightly dentated at the edge thus formed. Or it may also be described as *a fork* with the outer teeth somewhat enlarged, truncated at the apex and so forth. As far as I know, this variation from the usual form of the mentum is repeated in no other *Carabideous* insect. The other parts of the mouth have not much to distinguish them with the exception, however of the labrum which attains a very extraordinary degree of development occupying *rather more than one-third of the whole head, although the latter itself is large and heavy.* It is of a suborbicular shape, very slightly produced in front into an obtuse angle, is vaulted, covers the mandibles, has two longitudinal impressions at the sides of the base and is highly polished. The head has two impressions in front of the eyes, is densely punctured and thinly pubescent, it is strongly but gradually contracted behind the eyes

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and formed into a short neck. The antennæ are strong, and reach to the shoulders, joints 1 3 and 11 are of about equal length, middling, the former two subcylindric, joint 2 is small, rounded, 4-10 subequal and with the 11th oval. The thorax is small, only half as large as the head, rather narrowed, strongly transverse, twice as broad as long, slightly emarginated in front, the anterior angles rounded, contracted below the middle, subquadratic and prolonged at the base, posterior angles depressed, longitudinally divided by a deep furrow. The elytra are striated and, as well as the thorax, densely punctured and thinly pubescent. The legs are strong, simple and subequal, the anterior tibiæ are deeply notched, the first joint of the tarsi is as long as the two succeeding ones together, subcylindric, the 2nd triangular, the 3rd of a similar but more transverse form, smaller—all three have the apical angles acuminated, the 4th is large and deeply bilobed, the 5th middling, thin, the claws simple. The tarsi are altogether short and strong, the first joint is furnished with longer, the 2nd and 3rd with shorter stiff hair, whilst the 4th is strongly penicillated below. The anterior tibiæ are slightly spinose, the others more so.

I believe the only specimen of this insect which has hitherto come into my possession, and which has served as the type for the above description, to be a female.

Trib. GALERITIDÆ.

Heteroglossa. n. g. N.

Corpus oblongum, subparallelum, depressum tenuiter hirsutum. Caput mediocre oculis semiglobosis, sat prominulis; collo brevi. Mentum sat profunde subquadrate emarginatum, lobis magnis extus fortiter rotundatis, apice abrupte acuminatis, dente magno excavato, apice inflecto obtuso, magis minusve profunde sinuato. Ligula subcornea apice libera, truncata, vel quadrata vel obconica vel leviter bi-sinuata, paraglossis cylindricis, marginem anteriorem longissime superantibus, magis minusve arcuatis. Palpi hirsuti, art. ultimo sat elongato, subcylindrico, apice truncato vel subtrigono. Labrum transversum antice emarginatum. Mandibulæ validæ, trigonæ, apice arcuatæ, basi pluries dentatæ. Antennæ robustæ, corporis med. attingentes, art. 1° incrassato se-

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quentibus 2 longiore, 2° parvo, 3-11 subæqualibus. Thorax subcordatus, basi transversim truncatus leviterque prolongatus. Pedunculus brevis. Elytra apice fortiter subquadrate truncata, costata, costis 16 majoribus, in interstitiis subtilissime bicostulata, in sulcis (sulco e tribus inter costas binas majores medio excepto) tenuiter pilosa, in omnibus transversim regulosa. Pedes anteriores tibiis sat fortiter emarginatis, tarsis maris art. 1-3 leviter dilatatis, subtus squamularum seriebus 2 munitis, art. 1 elongato-trigono, 2-3 rotundato-trigonis, 3° præcedente parum minore, 4° parvo cordato 3° plus sesqui minore, his omnibus angulis acuminatis, 5° magno, unguibus simplicibus.

This diagnosis may appear somewhat vague, still I have been unable to express the characteristics of the insects from which it is drawn in more precise terms, although they have features quite peculiar to themselves by which they are easily recognised when once seen.

The points on which the three spec. which form this g. more or less disagree are the following : 1, the labrum: this is more transverse in *H. elegans* and less deeply emarginated in *H. ruficollis* than in the other two spec. respectively—still in all three it is *emarginated* and has moreover the peculiarity of being furnished with bristles at the two anterior corners : 2, the mentum : this is subquadratically emarginated, the lobes being strongly rounded on the outer side, and abruptly acuminated at the apex, at the base of the emargination it is furnished with a broad, excavated tooth which is inflected and obtuse at the apex—so far all three species agree—however, whilst in *H. elegans* and *ruficollis* this tooth is slightly emarginated, at the apex, it is sharply notched in *H. bimaculata*, in fact bilobed, the lobes being large and rounded at the apex. I look upon this notch, which is sharp but not deep, as a mere variation from the emargination existing at the apex of the tooth of the former two species. 3, the palpi: these, labial as well as maxillary ones, have their terminal joint truncated at the apex—and so far again all three species agree—however, whilst this joint is of elliptic form in the palpi of *H. ruficollis*, it is in *H. elegans* only so in the labial ones that of the maxillary ones being cylindric at the base.

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In *H. bimaculata* finally, this joint is rather clubshaped or subtriangular and stronger truncated than in the former two species. 4, the ligula: this organ is of subcoriaceous texture, middling size, the shape of an oblong square, free and transversely truncated at the apex—these characters are common to all three spec. and in *H. ruficollis* I have nothing to add to it, however, the anterior margin, which is straight in this species, is slightly bisinuated in *H. elegans* the outer angles being acute and the central one obtuse. The ligula of *H. bimaculata* differs from both the former in as far as it is narrowed towards the apex and depressed towards the sides and the front, the anterior margin is otherwise cut away straight, without any sinuosities, but it is rather strongly armed with bristles. The paraglossæ agree in all three spec. in as far as they are highly developed, reach much beyond the anterior margin of the ligula and are more or less bent inwards. They assume their greatest development in *H. elegans* in which they nearly touch each other in front of the anterior margin, being cylindric and slender at the same time. In *H. ruficollis* the paraglossæ are somewhat shorter and straighter and in *H. bimaculata* still more so.

On all other points the three spec. perfectly agree; in saying which I lay particular weight upon the unusual sculpture of the elytra and the rather peculiar hairy vesture of the insects, bearing also in mind their general appearance, proportions, system of coloration, mode of living, etc. As to the hairy vesture of certain parts of the body and the sculpture of the elytra, it is true that these are not generally looked upon as of much importance, however, they appear to me to be so in this instance, as they present certain unusual variations repeated in all three species. The hairy vesture consists in thin yellowish or reddish hairs thinly sprinkled over the back and still more thinly over the whole of the lower surface of the insects, being at the same time longer at the latter place. This vesture acquires its greatest density on the legs, especially the tibiæ and tarsi, whilst their uniform presence at the palpi forms almost a generic character. The elytra are exquisitely sculptured into about 8 larger costæ on either of them and into 2 smaller ones between every 2 of these, the furrows thus formed are finely and transversely rugose and (with

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the exception of the central furrow between every 2 larger costæ) thinly pubescent.

It just strikes me that this sculpture of the elytra may occur in other GALERITIDÆ. If so, the insufficiency of my means to ascertain this fact with certainty, must plead my excuse for attaching undue importance to it. However, I should in this event, consider my books of reference, none of which say anything to that effect, greatly (and indeed more than myself) in fault, for not alluding to it, as in my opinion it is sufficiently peculiar to be mentioned.

After this lengthy preamble I shall have but a few words to say in finishing the description of the species.

45. *Heteroglossa elegans. N.*

H. supra rufo-castanea, capite obscuriore, maculis 2 humeralibus obsoletissimis ferrugineis; subtus dilutior, pedibus antennis oreque subtestaceis, elytris ad angulos apical. extern. testaceis; long. corp, 3½ lin.

In lacus Colombensis ripis, sub vegetab. putrescent. non infrequenter cepi.

An agile, pretty little insect of chocolate color, and with the general features of the family. Head smooth, polished, above and below slightly punctured, with 2 impressions in front of the eyes, anterior angles of labrum rather acuminated. Thorax deeper and more densely punctured than the head and with the elytra thinly hirsute, rather strongly emarginated in front, less so behind; sides, especially at the basal angles, depressed, divided longitudinally by a deep furrow. Scutellum, like thorax punctured and hairy. Elytra with the inner apical angle right and the outer rounded off, largely punctured within the margin especially near the apex. Tibiæ with a row of larger spines down the outer and a row of smaller ones down the inner side, 4-calcarate at the apex, the 2 inner spurs larger.

46. *Heteroglossa ruficollis. N.*

H. colore præcedentis sed obscurior, thorace pectoreque rufo-testaceis, antennis art. 3 primis nigrescentibus; long. corp. 4½ lin.

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Cum præcedente sed rarius et per occasionem nocte ad lumen cepi.

The shape of the body is quite that of the former but the insect is larger. The head is less distinctly punctured than in the former and there is an additional impression in the middle of the forehead. The thorax is also less deeply punctured, but the divisional furrow is more so than in the preceding species. The anterior tibiæ appear somewhat less deeply notched. There is nothing else to add to the description that has not been pointed out already.

47. *Heteroglossa bimaculata. N.*

H. subcastanea, thorace capiteque rufo-testaceis, elytris medio maculis 2 flavis pictis, pedibus abdominisque apice testaceis; long. corp. 5½ lin.

Ubi præcedentes infrequentissime legi.

Head, with the exception of the forehead, deeply punctured, with 2 impressions in front of the eyes, anterior angles of labrum rounded. Thorax densely and deeply punctured, with elytra thinly pubescent. The latter with a round yellow spot at the middle of each.

48. *Chlænius princeps. N.*

C. aureo-viridis, scutello cupreo, elytris nigro-viridibus ad basin et infra marginem viridibus, sutura nigra, subtus piceus, coxis trochanteribusque 4 ant. dilutioribus, femoribus trochanteribusque 2 post. testaceis, tibiis tarsisque obscurioribus, ore antennisque brunneis, labro, mandibulis limboque castaneis; capite obsolete ruguloso, punctulato; antennis art. 3° quarti prope longitudine; menti dente forti laciniis apice rotundatis; thorace ovato-quadrato, latitudine parum longiore, angulis ant. subrectis, post. rotundatis, basi fortiter 2-impresso, punctato; scutello canaliculato; elytris striatis, in striis punctatis, ad strias, præsertim apicem versus, tenuiter pilosis; long. corp. 8 lin., lat. 3 lin.

Specimen singulum f. prope Colombo sub-lapidibus cepi.

A very handsome species, distinguished by its size and comparatively great breath. The clypeus is impressed with 2 setigerous pits near the ant. corners. The labrum is transverse, slightly sinu

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ated in front, narrowed at the base and has the ant. angles strongly rounded off. The last joint of both the maxillary and labial palpi is cylindric and truncated at the apex, in the maxill. it is shorter than in the labial ones, in the latter somewhat narrowed at the base and slightly inflated at the middle, both appear slightly compressed at the apex. The elytra are strongly rounded at the apex. The insect has a very strong smell, somewhat like musk, about it.

49. *Chlœnius maleolens. N.*

C. capite. thorace scutelloque obscure cupreo-viridi-glaucescentibus. elytris obscurioribus, pubescentibus, maculis 2 subapicalibus flavis ornatis, subtus piceus, pedibus testaceis, ore antennisque brunneis, mandibulis limboque castaneis; capite ad clypei marginem post. profundis 2-foveolato punctulato, occipite leviter transversim ruguloso; antennis art 3° quarto subæquali vel paulo breviore; menti dente apice leviter sinuato; thorace subquadrato, lateribus leviter rotundatis, profundius punctulato atque levissime transversim rugoloso, ad basin 2-impresso, parce piloso; elytris densius pubescentibus, striatis, in interstitiis 3-8 utrinque ante apicem macula suborbiculari flava ornatis; long. corp. 6¼ lin.

Specimen singulum m. prope Colombo cepi.

Also a handsome and rare species, smelling strongly and disagreeably of creosote. Head thorax and scutellum are of a dull bluish green color with copper reflexions on the back, the elytra are of a blackish green, pubescent and adorned with 2 yellow spots between the middle and apex, this is of an irregular, rounded outline and stretches from the middle of the 3rd interstice across to the 8 stria. The 4th joint of the maxill palpi is subcylindric, that of the labial ones larger, plump and rather triangular. Tooth of the mentum not bifid but truncated and merely slightly sinuated at the apex. The elytra are narrowed at the apex.

50. *Harpalus (Ophonus) senilis, N.*

H. oblongo-ovatus, subdepressus, punctato-rugosus, griseo-pubescens, supra æneus, subtus piceus, ore pectoreque dilutioribus, pedibus testaceis, antennis basi palpisque apice flavis; capite robusto antice rotundato, postice parum angustato, thorace vix angustiore;

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antennis humeros attingentibus art. 2_o parvo, reliquis longitudine subæquali; mandibulis obconicis robustis, una unidentata, altera incisa; labro vix emarginato; palpis art. 4° ovato, apice abruptius angustato, leviter truncato; thorace transverso, longitudine tertia parte latiore, elytris vix angustiore, lateribus rotundato, infra med. leviter angustato, basi subquadrato, hic vix, antice leviter emarginato, angulis apicalibus obtuse acuminatis, basalibus subrecte rotundatis; elytris punctato-striatis, apice fortius 2-sinuatis et angustatis; tarsis art. 4° cordato; long. corp. 4½ lin. lat. 1½. lin.

Prope Colombo sat copiosus.

This as well as the succeeding two species fly very commonly into rooms at night during the rainy weather. The present spec. is a fine, comparatively large, robust insect. I may add to the above description that the emargination of the mentum is of middling size, its lobes rounded externally and its tooth just marked in the shape of a slight obtuse rising at the bottom of the emargination. The ligula is very small and narrow, the paraglossæ very large adhering to it and enveloping it fully and on all sides, the whole is very slightly cut away at the apical angles and slightly, but abruptly and rather deeply, notched at the centre of the anterior margin. I may further notice that some of the individuals before me have the apex of the maxill. palpi prolonged, cylindric and slightly bent inwards; as this is not a sexual distinction and as the insects thus distinguished differ in no other respect from the rest, I look upon them as curious varieties.

51. *Harpalus (Ophonus) rugosus N.*

H. præcedenti simillimus sed sesqui minor, magis rugosus, antennis robustioribus art. 5-11 ovatis leviter depressis, colore supra parum obscuriore, subtus dilutiore, pedibus albidis, coxis tarsisque brunneis, antennis totis castaneis; long. corp. 3½ lin.

The small size and, upon close inspection, the other peculiarities just pointed out, readily distinguish this species from the former in spite of their close affinity in other respects. They are both equally common about Colombo.

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52. *Harpalus (Selenophorus) Colombensis. N.*

H. statura præcedentis sed gracilior, glaber, supra læte æneus, subtus subcastaneus, pedibus albidis, coxis, tarsis, antennis palpisque testaceis, ore brunneo; capite transversim ruguloso; antennis præcedente tenuioribus, palpis gracilioribus apice magis angustatis; labro basin versus leviter dilatato; mandibulis infra apicem abruptius arcuatæ, una uni— altera bi-dentata; thorace lateribus præcedente minus rotundato, basi minus angustato, hic rugoso-punctato, antice leviter longitudinaliter strigoso; elytris striatis, parce punctulatis, in interstitis 3°, 5° et 7° punctis majoribus impressis; long. corp. 3 lin.

Prope Colombo sat copiosus.

A pretty little insect, very distinct from the preceding two. I may add that it also differs somewhat in the paraglossæ, the anterior angles of which are distinct.

Trib. HARPALIDŒ?

Compsolepis. n. g. N.

Corpus oblongum, robustum, subconvexum. Caput ovatum, mediocre; oculis semiglobosis prominulis. Mentum leviter subsemilunariter emarginatum, lobis extus rotundatis, dente vel parvo, obtuso vel nullo. Ligula mediocris, cornea, oblonge quadrata, apice transversim truncata, libera, paraglossis cylindricis apice truncatis, sat robustis, marginem ant. parum superantibus. Palpi articulo ultimo elliptico, truncato. Labrum apicem versus angustatum, apice rotundatum. Mandibulæ validæ, apice arcuatæ, una uni— altera bi-dentata. Antennæ filiformes, humeros parum superantibus, art 2° parvo, reliquis longitudine subæquali. Thorax mediocris longitudine parum latior, antice vix, postice haud emarginatus, lateribus leviter rotundatus, basi parum angustatus, angulis omnibus rotundatis, margine elevato. Elytra ovata, infra med. parum dilatata, apice leviter angustata et acuminata. Pedes subæquales, tibiis apice bicalcaratis, calcaribus intus subtiliter serratis, ant. leviter emarginatis, tarsis 2 ant. art. 1-3 leviter dilatatis gradatim minoribus, art. 1° cylindrico, 2° obcordato, 3° trigono, omnes art. 4° *maris* bilobo, *feminæ* bifido, art. 5° magno, unguibus validis, simplicibus,

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subtus tarsis 2 ant. art. 1-4, intermed art. 2°-4° squamularum longepedunculatarum seriebus duabus munitis.

53. *Compsolepis foliolosa. N.*

L. glabra, supra obscure brunnea, thoracis elytrorumque limbo testaceo, subtus brunneo-testacea; pedibus albidis; antennis art. 3 primis flavis, reliquis nigrescentibus; palpis art. ultimo testaceo, reliquis flavis; thorace ad angulos basales profundius foveolato; elytris striatis; prosterno canaliculato; long. corp. 3-4 lin.

Specimina nonnulla mens. Octob. prope Colombo nocte ad lumen cepi.

The internal vesture of the tarsi of these otherwise inconspicuous insects, constitutes their most important character and is altogether of a very interesting nature. I proceed at once to describe it at full length, premising that *I believe* I have both the male and female before me. The individual which I take to be the male is smaller and of a darker color than the other. The legs, with the exception of the tarsi, are the same in both sexes. They are of middling strength, the tibiæ are furnished with 2 spurs at the inner side of the apex, which spurs are finely serrated along their inner edge, the tarsi have joints 1-3 of the first pair slightly dilated, the posterior pair is elongated, subcylindric and the intermediate one forms a passage between the two. Joints 1-3 of the first pair decrease gradually in size, joint 1 being at the same time subcylindric, joint 2 rather cordiform and joint 3 rather triangular, joint 4 in all the six tarsi is bilobed in the male and bifid in the female, this character being, however, less distinctly expressed in the 2 post. tarsi than in the 4 ant. ones; joint 5 is large and the claws strong and simple, a membranaceous process of triangular form covers the base of the latter above.

The internal vesture of the 4 ant. tarsi of the *male* is of the following description. The inner part of joints 1-4 of the 2 ant. ones is furnished with 2 longitudinal series of peduncled squamulæ which are of a broad, triangular form and lie like tiles upon each other covering the sole of the tarsus, they are flanked by bristles which partake of the nature of the scales being dilated in the shape of a lancet. These squamulæ are without any particular color, they

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are unconnected amongst themselves, their edges are entire and and they attain their highest development at the apex of the 4th joint, in fact their development is gradual from the base of the 1st joint to the apex of the 4th. The intermediate tarsi, although not dilated, are similarly provided as the anter. ones, but only at the apex of the 2nd and at the 3rd and 4th joint, the squamulæ being of rather a square shape, triangularly prolonged and peduncled at the base; the 1st joint is naked in this pair.

The tarsi of the *female* are very much the same as those of the male, excepting the 4th joint which, as above mentioned, is bifid. A further distinction exists, however, in the squamulæ. In the 2 ant. tarsi of the female these are present at the apex only of the 1st and 2nd joint (hardly distinct at the former); however, they are well developed in the 3rd and very highly in the 4th joint, the squamulaceous bristles are less conspicuous but the peduncle attains extraordinary length in the 4th joint, the squamulæ do not cover each other like tiles but stand more freely and loosely and are curved inward so as nearly to touch in the middle, their shape is that of an elongated triangle, they are veined and their apical edge is serrated. Being such and placed upon long, slender, peduncles they forcibly remind me of the leaflets of certain ferns (Adiantum) and hence the specific name *foliolosa.* The intermediate tarsi are similarly provided, but, as in the male, the 1st joint is naked and the 2nd furnished at the apex only. The lower edges of the 2 posterior tarsi are very neatly fenced in with small closely set spines.

I feel doubtful as to the affinities of these insects, especially if in reality I have described both sexes and if the vesture of the intermediate tarsi is allowed to be of the same importance as that of the anterior ones, however, I think they must find a place amongst the HARPALIDÆ as restricted by Lacordaire. I must not omit to mention that the tooth of the mentum appears to be variable, one of my specimens (a male) being decidedly without it, whilst another is furnished with a small, obtuse one.

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V. *Observations on Provincial Exhibitions and the improvement of the Resources of the several Districts of the Madras Presidency. By* J. FORBES ROYLE, M. D.

1. The correspondence referring to the establishment of Provincial Agricultural Meetings for the distribution of Prizes in the several Collectorates of the Madras Presidency, is pregnant with important facts and inferences for the future improvement and development of the Resources of these Provinces. Considering the general state of information among the class of cultivators, not only in India, but in other parts of the world, it is not surprising, that the first enunciation of a proposal, in which money and jewels were to be given and nothing received in return, was received in some places with suspicion, and others with indifference, and in most with unwillingness to exhibit. All this is justly ascribed to the novelty of the proposed scheme and to the ignorance of the great mass of the people; where it is said, "The person most "respected among the Hindoo population, is the man who does as "his ancestors have done; and who, on all occasions upholds the "*mamool* or custom. The person looked upon with suspicion, is "the man who troubles the village with change and novelty." Coll. page 157.

2. Though the success of Exhibitions in this country is appealed to, and spoken of as a thing not to be expected in the East, I am far from participating in the sentiment. For I happen to be one of those who practically experienced the difficulty of inducing those who were the most able, to be the most ready to contribute to the Great Exhibition of 1851. Having been entrusted by the Royal Commissioners with the Department of Raw Products, my principal business at first was to induce parties dealing in different classes of Raw Products to contribute collections of specimens of the Articles in which they dealt, in order that the Great Exhibition

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of 1851, as it was wished that this being the first of the kind, should contain a complete collection of all the Raw products, which were known as Articles of Commerce. In representing the objects contemplated and requesting different parties to contribute, so far from alacrity, I found, with certainly some striking exceptions, disinclination in many to whom I applied, to contribute. They alleged that it was useless to exhibit things that were so common and known to all the world, and which each and all in the same business might contribute equally well. Difficulties were, however, overcome, and will be so elsewhere with perseverance, especially as it is proposed to continue the Madras Exhibitions for two or three years. It seems desirable as suggested by some Collectors, that facilities should be afforded for sale and barter. The success of European Exhibitions would be very limited, if it were not for the opportunity afforded to manufacturers of making known and selling, or taking orders for the sale of goods.

3. Though local officers are the best judges of the times at which the proposed distribution of prizes should take place, as well as of most of the things which require to be encouraged in their own districts, yet there are other points which can be as well, if not better settled, by those at a distance who have paid attention to such subjects or have watched their working in foreign markets.

4. The first point deserving consideration is, whether the productions of a district are intended for home consumption, or for export to foreign markets. In the first case, the people of the district are themselves the best judges of what they require, and what they wish to have improved, or what to have introduced as new cultures among themselves. In the second case, the purchasers in foreign markets, or their agents and brokers, are the best judges of what are the defects of any known product; or what are the kinds of substances which are most likely to meet with purchasers, when first introduced into their markets. But there are few important cultures which may not be noticed under both heads, and to which therefore the same general observations may apply. Thus there are few Indian products, or rather few products sent to market by

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the natives themselves, which may not be greatly improved in the state of *cleanness* or of *preparation* in which they are sent to market.

5. In the Ganjam district the Collector says, the people are not only " very bad cultivators," but they will not take the trouble to clean and separate the good and bad seeds, nor learn that good rice is often rendered of much less value, from the intermixture of even a small quantity of inferior dark coloured grain. This was in vain urged on the Ryots of Polaky, by Mr. Linares, a merchant of Calingapatam, Coll. p. 27. But even in the district of Canara, where the inhabitants are said to be " generally alive to their own inter-" ests," and where " some departments of Agriculture are carried " to a high pitch of perfection," " the methods of preparing the articles for the market are often exceedingly defective," Coll. p. 154. But nothing can be worse than the practice alluded to by the Collector of the same district, and said to be almost peculiar to India " that is the system of *Nerick* or fixed price. A candy of " tobacco for instance is brought down to a low price by means of " adulteration; the dealers have no resource, but to adulterate all " the tobacco down to that value. For it is not the custom of the " country to say, bring it me unadulterated and I will pay you a " higher price. This is never done," Coll. p. 160. So the cotton of India never realizes the price which it would command, if sent in a clean and unadulterated state; for the consumers being accustomed to meet with a certain proportion of dirt, reduce the price at which they purchase, so as always to cover their loss, this in addition to the shortness of the staple, assists in keeping Indian cotton at a low price; so likewise the want of due preparation prevents some Indian fibres, otherwise of good quality from attaining their full value.

6. Though this subject is not alluded to by all the Collectors, it is one of the greatest importance; for if the cultivators of India could be convinced of the benefit which would ultimately result to themselves, a great good would be effected. For the higher prices which Indian products would then command in European markets, would enable local purchasers to give a better price than they now can, to the actual producers of the goods. Prizes might therefore

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be well given for ordinary products carefully harvested, or well cleaned and prepared for market, especially when such are also articles of export. It is probable that local merchants would at once give a better price for an improved article, though it might be some time perhaps, before they were able to do away with the prejudice against Indian products, because they are usually badly prepared, and themselves be able to reap the benefit of improvement.

7. The next subject which we may consider as deserving encouragement, is that of the crops themselves, both in respect of the quantity as well as the quality of the several cultivated products. This will, of course, be different in the varying soils and climates of the Presidency. Much may no doubt be done in this direction by the Native cultivators, if they feel inclined, for instance by the selection of the best kinds of seed in their own districts, or by interchanging such with similarly selected seed of other districts, so also by the more careful culture of the soil, eradication of weeds, thin sowing, drill husbandry, rotation of crops and though last, not the least important, by the application of suitable manure. All of these practices, the Natives of some districts at least of India, are well acquainted with, but in the proper use of them few Europeans in India are able to advise, as they have not usually studied or practised Agriculture, and are apt to think that improvement consists in the introduction of European tools and practices into tropical countries; without in the first instance proving that these are the most eligible. The American planters found the culture of Cotton in the west of India well suited to the plant, the soil, and the climate; and therefore turned their attention latterly chiefly to the cleaning of cotton. It appears to me that much good would result, if careful enquiries were made respecting the Native mode of cultivating different crops, and pointing out such as were most successful by the results which they produced.

8. So also with regard to the tools employed by the Natives in their Agriculture. They seem rude, but they are cheap. The chief enquiry should be, are they effectual for the purposes for which they are employed. Thus the Collector of Cuddapah says, that the Agricultural implements in common use in the district,

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are of a very rude nature, "though they answer the purpose exceedingly well." Some of these implements are no doubt susceptible of improvement. But such improvements can only be made by those well acquainted with the working of the several tools, and in the direction in which, and the extent to which charges require to be, or may be carried. The simple introduction of English ploughs, which has been so often tried, is of little practical value, for they require larger cattle than are commonly used, and those must be supported on better food than is usually supplied to Agricultural cattle in India.

9. It is quite possible, however, for the Natives, if they pleased, to grow crops which would be valuable either for sale, for cattle food or for manure: as for instance, several of the oil seeds. These are already grown, as being useful to the Natives for their oil, or as exportable articles; but no where I believe to the extent that is practicable. A part of any extra crop of these oil seeds might be sold, but a part or the whole might be expressed, and the oil only sold. The residual oil cake would serve for food for cattle, and the manure from these animals, if not burnt, would be useful for fertilizing the much impoverished fields. Or if the farmers pleased, the oil cake would itself serve as manure since it has been found from numerous experiments made in this country,* that oil-cake is one of the best manures for cereal crops. But I propose shortly calling attention to this subject, as it seems one likely to overcome a pressing difficulty.

10. The third head under which the improvement of districts may be considered, is that of the introduction, and culture of new substances, or of such, as though common in one district, are unknown in another. This is a department in which, no doubt, much may be done for increasing the comforts of the people, either by bringing within their reach, articles of culture which may be consumed on the spot, or furnishing them with products which may be valuable for export; and enabling the people to exchange them for the valued products of other countries. But much caution is required in recommending for culture, any articles, which though

* *i. e.* in England.

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valuable in one district, may fail in another, merely from too rigidly following the mode of culture which is found most suitable to another district, where some little observed circumstance may differ. For successful culture depends upon a due consideration of soil and of climate, as well as of a due adaptation to these of the modes of culture.

11. Not only however must the culture succeed, but there must be a demand on the spot for the article produced, as is well observed by several of the Collectors. Thus, the Collector of S. Arcot says "I do not believe that anything short of an assurance "that a remunerative price will be immediately given, will induce "the Natives to attempt the cultivation of any novel species of "produce." Coll. p. 10. So again in Tanjore the Collector writes, that the "Collectors have no desire for speculation, and no faith "in mere assurances that articles fitted for the European trade "will meet with a ready sale at Madras, I believe that nothing "will overcome this scepticism but the presence in the Provinces "of the Agent of some Mercantile firm, prepared to pay in ready "money for all produce suited to his purpose. In Rajahmundry, "in Vizagapatam, and in Ganjam, the Sugar Works are thus car"ried on, and in Cuddapah many lacs of Rupees are annually ex"pended on account of Madras Merchants in the preparation and "purchase of Indigo." Coll. p. 123. From Canara the Collector writes "In this district the Ryots want little encouragement to "cultivate any articles, beyond a certainty of remuneration. But "it is of no use to tell them that an article is of value in a distant "Market. This is nothing to them, the only question is, if they "produce it, will any one give them money for it here. If they "will, they will produce it immediately." Coll. p. 159. Thus he states, "that he considers the *Sunn** or Indian Hemp (probably "*Crotolaria juncea*, or *tenuifolia*) to be the article which promises "best, and has a full belief that if there shall be a steady demand "for this article for the next two or three years, instead of being

* *Note.*—Specimens of this Canara Sunn having been examined by Practical Men, both in England and Ireland, has been pronounced to be well suited to the English Market, but it must be as cleanly prepared as the sample specimens.

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" raised in a few villages on the coast to supply the fishermen with " nets, it would become one of our staple products. Almost all " the land flat enough for rice fields has been taken up, but we " have many thousands of acres of land of the same quality as " that upon which the *Sunn* is growing, lying unoccupied." Coll. p. 156. He adds we have lately had an instance in the case of Fish-Oil, and the neighbouring country affords one in that of Coffee, that a brisk steady demand is all that is wanted to introduce a new article of commerce. Coll. p. 182. So the Collector of S. Arcot writes " a few years ago the ground-nut called Manilla " Kotay (*Arachis hypogæa*) was unknown hereabouts, but no " sooner was a remunerative price offered on the spot by a Mer- " chant of Cuddalore for such produce, than it was extensively " cultivated, and the oil from it largely exported." Coll. p. 110. Hence it is evident that in proposing to the Natives to grow new products for foreign Markets, it is not enough that these are valuable and in demand in such Markets, but we must take care that there are local Merchants who will at once take them off the hands of the Native Cultivators.

12. The same observations will apply, but in a still greater degree, if we wish them to cultivate articles, not known in European Markets; that is, such as are possessed of valuable properties and which might become important articles of commerce, from being likely to be useful in many established Manufactures, for instance a new dye, an oil seed or a fibre, as all such are in constant demand and would be readily employed by some Manufacturers. But if sent into an English Market with only their Indian names, and some account of their properties, they would be pronounced to be of "no value" because "unknown in the Market." In such cases, the substances which have most chance of being employed, are those which are most like in properties to others which are already in use; and for which they might be employed as substitutes, especially if they can be sold at a cheaper rate, and are likely to be supplied in large quantities. Some articles which have long been known experimentally would at once be employed by Manufacturers if there was any assurance of a regular supply,

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as the vegetable butter of Canara, or the oil of either species of Bassia, known as the *Illuppu* and *Mowah* trees. So also the *Sunn* fibre of Canara, if prepared like the "Wuckoo Nar" of Travancore, or the best hemp of Bombay would find a ready market. Other substances which are less known, must go through the same course that these have done, before they can be enquired for. That is they must be reported upon, written about, experimented upon by Manufacturers statistical information respecting prices and probable quantities supplied. After such a course the enquiry probably would be "why, if there are such things, do they "not come to us, as we are ready to employ them." For this is the case at present with the above vegetable fats, and the Rheea fibre which is identical with the much valued product called China Grass.

13. It is no doubt in consequence of the numerous difficulties met with in attempting to improve the culture of a district or in introducing into it new or little known articles, that some Collectors have recommended the establishment of experimental farms. Thus the Collector of Masulipatam states that "to a great degree the "Ryots of this country require as much teaching as children, "when any new product has to be introduced. Were there any "experimental farms under the charge of some one thoroughly and "practically acquainted with the best mode of raising and bringing "to maturity different classes of valuable products, much valua- "ble information as to the productions, really best suited to the "soil and climate of each district, would be obtained, and the "Ryots would be more encouraged by the actual sight of the pro- "duce grown on the Government Farms than by a thousand orders, "or the most benevolent advice from the Collector and his subor- "dinates." There is no doubt that much good might be and perhaps would be produced by such experimental farms, if they were efficiently, and also successfully carried on. But they would have to be successful not only in producing good crops, but also in proving that these were profitable ones. This there is great doubt of there being for some time, in consequence of the extreme difficulty, if not impossibility of finding well informed and efficient agents

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to take charge of them. For almost any one that was appointed, would have much to learn, before he would be in a position to teach. The expense of such a process, carried on in several districts at the same time, would be a bar to its adoption, besides that the several failures which would at first occur, would, for some time at least, operate as a discouragement against the adoption of some, even of their successful experiments.

14. The Board of Revenue suggest the propriety of ascertaining whether the Government Cotton Farms have really exercised any permanent influence, and whether the cotton of the Districts in which they were established is sensibly superior to the produce of districts not similarly favored. On this it may be observed, that the inferences drawn from attempts to grow an exotic species of cotton in all the different parts of India, would hardly apply to farms intended to grow only such things as are suitable to each particular district. But even with this exotic species of cotton, it would be found that the Government farms have produced permanent effects only where the climate was suitable to the American species of cotton. For instance, no effect will be observed from the farms which were established in the Bengal Presidency, as the climate was not suitable to the plant; still less so when it was cultivated according to American methods, and all the farms were given up before suitable modifications of culture could be determined on. In Broach great success has attended the cleaning of cotton by Amerian machinery, while in Dharwar and neighbouring districts 60,000 acres are under cultivation with American cotton, which brings the highest prices of any Indian grown cotton in the English market. In Coimbatore good cotton was produced and at a remunerative rate, according to Dr. Wight's statements. If the uncertainties of season have not thrown discouragements in the way of cultivation, some permanent effects ought to have been produced, though the Natives there, seem never to have taken to the culture of American cotton as in Dharwar, and though the Government engaged equally in both districts to purchase all that the ryots would grow.

15. As considerable difficulties would be experienced in the

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establishment of experimental farms and the several districts of the Presidency, they would probably prevent their influence being so extensive as might be wished, and therefore render inadvisable the establishment of such farms. But there is a great variety of useful and very valuable information, which is at present required, and which can be only attained by means of one or more experimental farms, and which when obtained might be made applicable to the improvement of the culture of various districts. First, in ascertaining the best methods of culture of the different Indian crops, according to the practices of the Natives themselves in the parts where any crop is best cultivated, comparing these with the principles and methods of culture, at present most approved of in this country; in ascertaining the peculiarities and advantages of the different methods of culture, of cropping, of rotation, &c. together with the use of such manures as are procurable; trying the merits of different tools; and making known the easiest methods of raising water; and in addition, introducing the more valuable articles of culture from other parts of the world, which have any similarity in climate and vegetation to India. Such experiments are too often confined to introducing English cereal crops, vegetables and fruits, into situations where the soil and climate are so dissimilar that any great success is hopeless. If such an experimental farm were established near the Presidency under a Government officer, and at the same time in connection with the Agri-Horticultural Society, it might also be made a school of instruction in the principles and practice of Agriculture for young men from the Provinces. These might be selected in the first instance by the several Collectors, and then sent to the Presidency, where they should, like the Native Medical Students, pass through a course of elementary, scientific and practical instruction, and like them be subjected to examination. If they passed such an examination satisfactorily, they might then be sent back to the Collectors for appointments in the several districts, of different natures, according to their respective merits. Such a course would, without any great expense, introduce throughout all the different parts of the Presidency a body of tolerably well qualified individuals, who might be the medium of communication between the Collectors and Ryots in all matters relating to improved

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culture; and might themselves superintend an experimental field of any particular culture, in order to give a practical proof to the Ryots of the mode as well as of the advantages of the new culture. It has been found advantageous even in Ireland to send round a body of qualified instructors in improved farming and flax culture.

16. Further, the Board of Revenue call attention to the fact, that several of the Collectors suggest prizes for the improvement of cattle, sheep, &c., and as they consider it a matter of great consequence, recommend its adoption. They also propose enquiring whether it would be advisable in some districts (as Tanjore, &c.,) to introduce a few cattle from other districts at the expense of Government. Thus the Collector of Tanjore writes, "there is pro- "bably no part of the habitable globe, and certainly no part of India "which produces such miserable animals, as are commonly used "here. The whole country being under irrigation, there is no pas- "turage whatever. During the time of the cultivation they are fed "on the last year's straw, and when the harvest is over they are "turned into the fields to find what subsistence they can on the stub- "ble." Coll. p. 124. The first observation that presents itself on reading this statement is, that not only is it not surprising that the cattle should be reduced to this state, but it is hopeless trying to improve them, unless some better food than the dried rice straw of one season and the stubble of the next, is provided for them. The improvement of the breed of cattle and of sheep is now conducted on scientific principles by careful observers, but in no case I believe do they attempt to make crosses and raise the character of a breed, without at the same time taking care that food is supplied which will suit the improved breed, whether it be of sheep or of horned cattle. The Board observe that the cattle of Nellore, Mysore, Coimbatore, &c., and the buffaloes of Canara are known to be very fine, and a little judicious expenditure in this way might be productive of much advantage. Having called attention to this subject in my essay on the Productive Resources of India, p. 139 and 161, I would beg to refer to the principles laid down by different breeders. Among the first of these, is the great importance of climate, secondly of pasture. You must first of all be in possession of a pasture suitable for the new comers, &c., also to the objection of breeding *in and in*,

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and to the advantages of bringing the breed to the required size or fineness by one or two crossings, rather than attempting at once what we may wish for ultimately. But the subject is well understood in some parts of India, as is evident from the greatly improved breeds of horses and of cattle. The latter both in Harriana in the North-West of India, and in Mysore. The officers in charge of such establishments should therefore be consulted on the best course to be pursued.

17. It is probable that the Natives might be induced to grow some crops which would themselves be profitable, and the refuse useful as food for cattle, for instance the *Sorghum** of which the stems are nutritious, and given to cattle in different parts of India, and as I have suggested, oil seeds might be cultivated, of which the oil might be sold and the cake given to cattle. The Experimental Farm would be useful in eliciting information as well as in confirming and recommending whatever practice was most approved of.

18. Further, a very excellent suggestion, and likely to be productive of useful results, was made by the Collector of Madura, and considered worthy of adoption by the Board of Revenue, that is, that Government should at their annual meetings for the distribution of prizes, take advantage of the opportunity of exhibiting models or specimens of improved implements, such for instance, as simple methods of raising water, improved methods of cleaning cotton, or of separating fibres, models of oil and other mills, &c. according as might be thought advisable in different districts. The Collector of Madura suggests some Carpenters' tools, also ordinary Ironmongery such as locks, latches, &c. The Board of Revenue also suggest the exhibition of improved produce from other districts, as desirable for a district where a new culture is proposed or commenced. All these are useful suggestions, and very important in a country like India, where, though some of the Arts have attained a high degree of perfection, others have remained in a rude and unimproved state for ages. From the advance which the Natives of India have made in so many of the Arts and Manufactures, there is every reason to anticipate that they will do so in

* Jowari or Cholum.

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others, indeed this is proved by their imitation of European Arms, Ship building, &c., and by the very remarkable fact of two Natives, named Soobaroidoo and Venkatareddy of Dowlaiswarum having, in the preliminary exhibition held at Rajahmundry, exhibited two *working models of Steam Engines* made by themselves; upon which the Right Honorable the Governor in Council observes—" It will " not be the least valuable result of the large Engineering Works " in the district, that they have tended to introduce among the Na- " tive community a taste for Engineering Mechanics, and a know- " ledge of the subject which, especially at the present time, is like- " ly to be most valuable." At the same meeting a Power Loom imported by Mr. G. H. Faulkner, was the great point of attraction, and its operations were earnestly watched by thousands.

19. In conclusion " the Board consider it of great importance " that (these) difficulties should not be overlooked, but they view " them not as symptoms of ultimate failure, but as indications that " the measure must be carried out with steady perseverance, and " that no want of success at the outset must be allowed to cramp " the efforts of Government." It remains only to add that the proposed measures for the improvement of the several districts, as well as the lists of their products and the prizes to be awarded for them, as well as the results which are obtained, should be printed, in order that the information may be generally diffused.

20. The two preliminary meetings in the districts of Guntoor and Rajahmundry, having been as satisfactory as could have been expected with so little previous notice, it has been proposed to hold during the year 1856 nineteen agricultural exhibitions in different districts of the Madras Presidency, and as the Governor General in Council has confirmed the expenditure of 58,000 rupees for the purpose, the measure promises to be as useful as any other public work in India.

Connected with the correspondence respecting the establishment of an Exhibition of Arts and Manufactures at Madras, and of others for the distribution of prizes for agricultural products in the pro-

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vinces, is a recommendation from the Government of Fort St. George for the establishment of a BotanicalGarden at Madras and for the employment of not less than two able and experienced Botanists and Mineralogists who should be kept continually moving about the country, in order that a thorough knowledge of the rich and varied productions of Southern India might be rapidly acquired and turned to account.

In the Minute of the Right Honorable the Governor, regret is expressed that nothing more (that is than assisting the Agri-Horticultural Society) should have been done by Government for gaining an extensive and practical knowledge of the botanical productions of this province, that is the Madras Presidency. This observation appears to me should have been qualified with the words "at present," for I believe that much has been done at different times, and that we possess as good a knowledge of the Botany of India including the Madras Presidency, as of any other extra European country. Much of course still remains to be done as in most other countries, but the want at present is rather to systematise and to render easily accessible to the public the information that has been accumulated, than to make investigations by the aid of those who would have to spend some time in becoming acquainted with what has already been done, before they could proceed to make new discoveries. That I do not take too favourable a view of what has been done, it would be enough to refer to the preface, p. XI. of Dr. Wight's Prodromus to the Flora of the Peninsula of India, where the labours of Kœnig, of Anderson, Berry, John, Roxburgh, Heyne, Klein, Buchanan Hamilton, and of the venerable Rottler, are referred to. Of these, several were supported by Government in their investigations. Dr. Wight's own, though incomplete work, is itself a record of what has been done to a certain extent, and no better service could be done for diffusing a correct knowledge of Peninsular Botany, than the completion of this work. In his illustrated work "Icones Floræ Indiæ Peninsulæ," he has given excellent representations of about 2,000 Peninsular plants, independent of 300 plants figured by Dr. Roxburgh in his Coromandel plants and those in Rheede's Hortus Malabaricus. Dr. Cleghorn,

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Professor of Botany at Madras, has himself made extensive Collections and numerous drawings of the plants of the same part of India.

Instead, therefore, of employing Botanists from Europe to make fresh investigations, I conceive that it would be much more beneficial for the diffusion of a taste for, and a knowledge of, the vegetable productions of the Peninsula, to employ a man like Dr. Cleghorn, who is as well qualified for the task as any man likely to be found here, to prepare a manual with brief characters of what is known of the Botany of the Peninsular. But contrary to the opinion of Dr. Wight, expressed at p. XXIII. of his preface, I would advise the careful addition of the Native names of plants, as I have always found, that such as are of use and are therefore important, have names by which they are well known to the Natives. These names no doubt differ in different districts and applying them may be more troublesome in the Madras Presidency than elsewhere, from the languages differing so much in different parts, but this very fact makes the task more necessary. If Dr. Cleghorn, could afterwards, or even at seasonable parts of the year, make excursions into neighbouring districts, he might usefully make any observations on the Geographical distribution of the plants of the Peninsula, especially as connected with soil and climate, as these would give principles for the cultivation of some and the introduction of other plants.

The above point is independent of that of the establishment of a Botanic Garden at Madras which is recommended by the Right Honorable the Governor. This however is not the first time that there has been such an Institution at Madras, for without referring to the times of Dr. Anderson, there was formerly, if I am not much mistaken, a Botanic Garden at Madras, of which Dr. Wight was Superintendent at the time that it was abolished, that is when Mr. Lushington was Governor. This, however, does not militate against the establishment of another Garden with definite objects, that is for the introduction of useful plants of other parts of India, or other warm countries and for the culture of Horticultural and Agricultural Products. This I would therefore call an experimental

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rather than a Botanical Garden, though it might be appropriately placed under the superintendence of the Professor of Botany with the aid of a well educated gardener who would more readily learn the peculiarities of Indian culture than any one not so educated. This is well evidenced in the case of Mr. McIvor, now in charge of the Garden at Ootacamund, and whom I selected out of several candidates, as he combined in the highest degree, a knowledge of the principles with the practices of Horticulture.

Though fresh Botanical investigations do not seem to me to be necessary at present, it is very different with Mineralogical and Geological enquiries, for the Madras Presidency is filled with mountainous ranges which abound in Geological treasures, a correct knowlege of which as of the Rock formation, is greatly required. For this purpose one or two qualified persons might well be appointed; and if one excelled as a Geologist, the other should be well qualified as a Mineralogist, having sufficient knowledge of Chemistry, to be able to give a good account of the various soils which might be met with. All such information would be practically useful by affording data for the improvement of the Agriculture of the several Provinces.

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VI. *Journal of an Expedition over the Annamullay Mountains for the purpose of examining the Teak Forests, and ascertaining by what line the Timber could best be carried to the Coast.* *By* CAPTAIN FREDERICK COTTON, C. E.

Left Cochin at 2½ P. M. in a boat with 10 oars, the tide and wind in favor. Reached Allwye before sunset. The river there becomes shallow, but the boat, with the crew out of it, was taken over the shoals without difficulty, the tide being at the time about half flood. From Allwye to Sheura (4 miles) the river is very shallow, but the boat was hauled over the sand-banks in a foot or 15 inches water. At Sheura, the Rajah of Cochin has a bungalow, and he is now living there for bathing; which he has the good taste to prefer in fresh water and comparative solitude than in the brackish water and most miscellaneous mob at Allwye the fashionable watering place of the Cochinese, who at this season emigrate there in great numbers.

Allwye has one essential as a bathing-place, which is, that the water is so shallow an infant may learn to swim in it without danger; but beyond this, I see no other advantage in the small stream to make up for its dreadful popularity. Above Sheura the river makes a bend by which at least 3 miles are lost in distance, and as I met with several shallows in different parts of the stream my progress was so slow that it was nearly daylight before I reached Malliatoor. The Allwye river is very much in character like the upper part of the Baypoor and Cotiaddy rivers of Malabar; but the banks are lower, and the country on either side differs, in the absence of those laterite knolls which occupy so great a portion of that district.

Malliatoor is a small village belonging to Cochin, on the north side of the river, inhabited by Roman Catholics, whose houses are exceedingly good, as should be their morals also, seeing that

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in this Parish of some fifty houses, there are no less than three Churches. On enquiry however, it appeared that the whole respectability of the place depended upon its active smuggling trade, which works so successfully for those engaged, that its ecclesiastical endowments are well supported.

On the opposite side of the river, the Travancore Circar has an Establishment for working the neighbouring forests; from which 800 logs of Teak are annually exported. The Conservator has a bungalow here, and though the jungle begins at this point, it is not considered feverish at any season of the year.

Elephants are caught near Malliatoor in pitfalls; and after two years it is considered safe to use them in their old haunts. It is at this season that they are taken, the want of water in the jungles driving them to the large streams; near the banks of which, the pits are dug. Fifteen elephants are kept at Malliatoor for the work in the forests; but after the beginning of January, water becomes so scarce in the hills, that they can no longer be employed. I find that there is a well-beaten path from this to Annamullay in the Coimbatore district which is kept open by the smugglers who bring Tobacco from the Palachy Talook, for sale in the Cochin Territory.

On the 7th, I visited the Malliatoor Hill, which is only marked in the printed map as a Theodolite station, but is not named. For the first mile and a half, I walked over cultivated fields; but beyond them, I began an ascent which continued for a mile, and brought me to the summit of a rocky knoll, having a command of an extensive view. To the westward I could distinguish every thing as far as the line of coast, but eastward, there was nothing to be made out, save a confusion of low hills, buried in the densest forest. None of these appeared to be of any considerable elevation; but in the sameness of colour, and absence of all marked features, it was difficult to judge either of height or distance.

On the rocky hill I had ascended, I found a very filthy little Church, which bears a character of such excessive sanctity, that it is said to be visited every Easter by from five to six thousand

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Pilgrims. I could not ascertain what had gained for the little hill the respect that it received; and could only guess that in their adoration of the type for the reality, the rubbish and confusion of the place might be considered typical of the Cochin Christians' creed. No one lives upon this hill, but the Chapel has a weekly visit from the Priests at Malliatoor: who at other times leave the Chapel to the care of a converted herd of Ibex; which graze on the steep hill-side, and shelter in the sheds and outhouses.

I saw fifteen of these very ugly goats about the knoll, all males, which was remarkable, and I should have entered them in this my diary, as having instinctively monastic habits, had I not been told, that there were many more in number of the other sex just out of sight amongst the bushes, which silenced the suggestion.

These civilized members of a forest family have not lost all the habits of their race in general. They saunter with composure on edges as sharp as knives, and stand with all four feet upon a single point of rock. Nor are they in character less wary than the Ibex tribe in general. Their cunning teaches them that they are safer in the sanctuary of the Church, than on their wonted haunts, the precipice; and having taken up their abode upon the sacred hill, they bask in perfect safety, as if aware that it was consecrated. In one of the Chapel offices, a black buck was lounging on a bedstead, who knew his place better than to take any notice of the Heretic intruder, and such was evidently the feeling of the herd in general. This seems to speak of good intelligence, yet judging by the head and face, the Ibex is a sheepish jackass. Dull as these animals appear, they are said to have all the cleverness of Priests, and when any thing goes wrong on the hill, one of the old bucks goes down immediately to report it in Malliatoor. Only a few days ago, one of these vigilant bergers is said to have taken the three mile walk, to ask a man in the village when he meant to pay that silver elephant he had promised to the Church if the pitfalls he was digging should prove successful. An elephant having been taken, and the vow forgotten.

28th March. A guide has arrived who gives the following

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statement of distances, and says that there is no open space after Toonacadavoo is passed. (From Malliatoor the river turns to the southward of east, and is no further navigable for boats, at this season.) To Attripully 20 miles north, Amakimtodoo 20 miles N. E., Oracumbum river 6 miles N., Yeddapally 20 miles N., Toonacadavoo 20 miles N. E., Annamullay 12 miles N. E. Total 98 miles. I know however that Attripully is not further than 12 miles; and the printed map gives me so much confidence in the rest being still more over-rated, that I shall dismiss all the people I can spare, and make the attempt; particularly since it is possible that the Tobacco monopoly may shortly end its days, when this path will close for want of use. If it was not for this man's statement, I should reckon upon one night only in the jungle, and the second I should hope to be at Annamullay.

The guide who has come forward to take me through the hills is a sturdy little smuggler with legs that look up to a mountain scramble; and with eyes that betoken more than the ordinary intelligence of southern Natives. When he was brought to give me what information he could, (or rather *would*,) I heard his voice at some distance round a corner, but could not see what sort of man I had to trust to; and twice I begged that he would show himself, without my wish being gratified. On inquiry into the cause of this, I found that one of the party round me was a Brahmin within 20 yards of whom it was not lawful for a *Teer* to stand. This little matter of etiquette being disposed of, I requested my Brahmin friend to take his leave that I might talk with more freedom amongst my equals. This Brahmin however, soft and effeminate as he appeared, was evidently on the same subject a man of information too; and unless he had a wonderfully retentive memory for tales of travel, had more than once crossed the hills by the smuggler's path. It would not however have been altogether right in me to suggest the possibility of his acting on free-trade principles, which in this little state rendered a man liable to hard labor on the roads in irons; and after being indebted to his civility for the knowledge of my little smuggler chief's residence, it would have been gross ingratitude to hint that his sacred

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limbs ought by law to have been *wearing chains*. I think it was rather to the annoyance of all present, that I made up my mind to start on the trip; but promises of a liberal present to my guide, and double pay to all the coolies who accompanied me, satisfied *them* if it did not suit those so well who had nothing to gain by my expedition, and might lose a profitable trade if Malliatoor becomes a thoroughfare.

28th March. At 4 o'clock on the following morning, I set off with Mr. Hamnett, the Civil Engineer's writer, who volunteered to accompany me, a servant also mounted 6 or 7 people to look after the horses, &c., the smuggler guide and 16 coolies carrying about half a load each. Having crossed over the village, we followed up the course of the river for about a quarter of a mile, then entered the jungle and travelled nearly due north. For the first two hours we got on very slowly and lost some little time in consequence of a peon having played us false about our torches; a trifle that might have made a great difference in the up-shot of one day's work, had we found the journey as long as we expected; for our guide had given us to understand there were but few places where water could be found; and our moving after dark without lights was out of the question.

As I rode I kept a Memorandum of all the beds of streams we passed; such changes as took place in the growth of the jungle; the nature of the country we were passing through, and, as well as I could, the general direction of the path we travelled. That memo. I will place on record, in case any one who succeeds me in my office, should wish to follow up the examination of the hills.

The jungle on this side is of large timber trees with a good deal of underwood every where. In some places indeed it was so blocked up with the prickly head of the ground rattan that off the pathway it was perfectly impenetrable. For the first nine miles there was very little bamboo and no teak.

The soil was black and moist, even at this, the driest season of the year.

We passed in this space four nullahs, three of which had water in

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them in puddles here and there; and one about the seventh mile, had a small stream running to the eastward. We crossed two low rocky ridges from 30 to 50 feet high, but the road was remarkably even upon the whole, till we reached the tenth mile, where we made a steep ascent; and crossed a saddle perhaps 150 feet in height, with hills on both sides. At this point a cut has been made through the narrow edge of the ridge to drag timber through, and the coolies knew it by the name of the Attripully Fort, though in passing it, I could make out no enclosure nor anything artificial, but the cut I rode through. It may however be that there is an embankment which runs along the ridge, as lines of fortification of this kind are found in all these Western jungles, even when the appearance of the forest otherwise, would lead us to suppose that man had never entered it. From this ridge we descended rapidly into a bamboo jungle and in about ¼ mile came to Attripully Fall.

At this point a guard of four peons is stationed by the Travancore Government as a check on smuggling; an establishment so far successful, if my *Teer* guide's information is correct, that the gangs, wearied with their journey, very generally, throw down their burthens here, and give themselves up to sleep, while the peons are cooking for them, and small blame either to the guard which might be raised to ten times its present strength, and would be still unable to resist the force, the smugglers on this path could bring against it. From the account these peons give of the fever at Attripully, I am inclined to think that though appearances are in favour of its being as unhealthy as a dense bamboo jungle could be, it is not by any means so bad as might be imagined; and our experience teaches that no one can say, except from actual trial, what are, and what are not, the spots where fatal fever may be found. Of the four peons stationed here, one was said to be absent with an attack of fever then; but it may very well have been that he was busy cooking for a smuggler's party or doing a little business in the trade himself. One man in four after a four months' residence is not so very bad a bill of health, considering how the men are housed, even supposing (what was most

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improbable) that their tale was true. Indeed from all I heard at Malliatoor about the fever, the forests on this side are not so dangerous as those particular jungles of Malabar, which we consider really fatal. It is true people talked of fever and men are said occasionally to die of it; but still it is not dreaded like the Carcoor fiend, or that awful pest at Bowally. And were I to make this trip again, I would not hesitate to spend a night at Attripully.

At this place the Codacherry river takes a sharp bend, and a ¼ of a mile above the turn there is a very pretty fall of 60 or 70 feet in height, very picturesque even now, when the water in the river is at its minimum. There is a specimen here of the effect of pebbles lodging where the rock is somewhat soft, and by the action of the water wearing holes into the river's bed, many feet in depth. The whole bed of the stream is perforated in this manner both above and below the falls; and several of the pits, after working down some fifteen feet, have broken through and left a flat arch of rock spanning five yards or more, with a large open space beneath, through which one branch of the river flows. This rill leaves the main stream by one of these tubular perforations and then passes below the rocky arch. It is altogether a curious spot and very picturesque. We stopped here two hours to rest and breakfast; and an addition was made to our party of two of the watching peons, come by orders of the Malliatoor Ameen to learn the road, and keep the information we obtained, for the use of any one who should wish to try the path hereafter.

The peons seemed terrified on hearing what they had to do, though one can hardly fancy why men living as these were, in a hut built in the branches of a bamboo bush, deep in a jungle full of elephants, should fear a change so trifling in their home, as they would find with us. But so it is; beyond this point they had never been, and they dreaded the unknown as much as if they had never left the pavement of a gas lit town.

As we gained the summit of one low hill upon our line of march, the guide pointed to the flat surface of the rock upon the right hand side and said "Many years ago a Christian Bishop was killed upon that stone."

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He did not know the name or nation of the man who died there, but seemed to have some reverence for the spot and spoke of the murder as a martyrdom.

Our road to this had been due north, or nearly so, and by our reckoning we had travelled 10½ miles. We now turned to east, north east, and left the river, though by the printed map the stream flows very parallel to the course we took. The path was well trodden all the way, and there were fresh notches on the trees showing that the smuggler had passed it the day before. This plan of notching the trees as they pass along must have been adopted by the smugglers when the path was less open than it is at present; for the road is now so clear that a horseman might canter along the whole of it. The traces of elephants though seen everywhere, were none of them very recent, proving beyond doubt that we were not near the banks of the large river. This had one advantage that it saved us from the risk we had run in riding to Attripully, of going when we least expected it, into well secreted pitfalls; which here and there, so completely "opened" the road to all that came, that we had cause to doubt from step to step the ground our horses trod upon. The pitfalls are of course dug where the elephants most frequent the forest, and at this season, as the minor rivulets are dry, their haunts are by the largest streams. After riding five miles we came upon a heap of teak timber, which had been cut a few years ago by the Cochin Circar, and left there, after they gave up working the forests. Now this, our guide, said was cut in a place called Nelliampoyd, but where that was he did not know. This was bad news, in one respect, for it showed me beyond a doubt that if I followed him I was not to go the path I wished most to see, that which led west of Annamullay. There was however, nothing to be done, the guide knew one way only, and that of course led to where tobacco was grown in greatest abundance east of the town of Annamullay.

In the first part of our ride there was a sad want of water, and when the trees did not meet over head, the heat was excessive; but where the shade was good, the temperature was most agreea-

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ble. From the absence of nullahs, we appeared to be following a ridge, and the direction was due east.

The path continued very level till we had travelled about 5¾ miles; when we began the ascent of a hill called by our guide Sholamooddy. The first ascent, which was at a slope of about 6 or 7 to one, occupied a quarter of an hour, after which, the rise was gradual for one mile and a half; the whole height being perhaps 350 feet. After turning the summit of this we descended rather rapidly for a few minutes, and came to the river which was reckoned upon as the end of our first day's march; if we were to be three days in getting through; and the coolies had been preparing me for a halt by complaining of fatigue. But I was to be saved a day in a way I least expected. As we reached the nullah the guide came running back with his hand over his mouth, and said in a whisper that the place was occupied by a gang of smugglers, which frightened the coolies out of their fatigue at once. I sent the guide on to tell the smugglers that I did not want to see them, and if they did not wish for a meeting, they had better get into the jungle out of sight; which they did, leaving one man at the edge of the wood to see, I suppose, what sort of party we were and what we did with the loads they had left. To my delight the coolies now pressed on; I counted the loads of 30 men, but had no further communication with the party. After two miles more, we came upon a small stream, and the guide reported another gang. These men all left the ground but one, who was the leader of the party, a fine manly looking Nair who evidently had too much at stake to be easily intimidated. The tobacco to the amount of about 30 loads was in heaps undergoing the operation of sorting, and was very lately gathered, much too wet to smoke, and acrid enough to have cured the most inveterate Virginian of his love of chewing. My coolies however could not overcome their taste for pilfering, and seeing that the smuggler was on peaceful terms with us, they began to rob the heaps, but this I put a stop to, and bought a bundle of the nastiness to satisfy them all; putting myself on a footing with the smuggler chief, and bringing myself under the Cochin Code, within the reach of section this, of regulation that.

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After a conversation with this man for some few minutes, we moved again, and very shortly began a long and steep ascent called Kurridy Kutum (alias Bear bank). This occupied us an hour and forty minutes, and was the highest hill we had met with. On the top of this, we had the first clear view, and very beautiful it was. We were on the edge of a spur, with a deep and narrow ravine on the left, and on our right there was a wide gorge with bold hills on either side, and a low but broad and picturesque water-fall lighted up the dark and otherwise unbroken forest.

From the end of this spur we descended by a path almost as steep as could be climbed about as many feet, as we ascended by Kurridy Kutum. At the foot of this we found a fine river, with a large and deep pool of the most brilliantly clear water. This river is known to the smugglers by the name of the Oracumbum, and it is evidently one of the main branches of the Coadacherry river.

Here we were to halt for the night, and if it were not that no one in these jungles can feel sure that he is not breathing poison, a traveller could not wish a more delightful resting place. I believe in most cases it is advisable to drink as little as possible of the water that is found in these very dense jungles, but this was too tempting and too delicious to be resisted, and if we were incautious in swallowing a large quantity of this beautiful stream, I made up for it in some degree by giving a pinch of quinine to every one of the party and taking the same myself.

Nothing could be more suitable for a bivouac than the spot we had chosen, a bed of high reeds grew along the river's bank, affording shelter from the wind which blew up the stream most agreeably for the evening meal; but rather too chilly for comfort or safety in the heavy dew of night. I had a cot with me which I Sir Humphry Davyed by musquito curtains; and as some luxurious smuggler had made himself a bower by tying the head of the tall reeds together, I borrowed his lodging for the night and had the snuggest lair imaginable.

There was very little conversation going on after the sun set, or

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if there was, I slept too well to be disturbed by it. I heard no sound till about 10 o'clock when I was awakened by a shout and all the people calling out that there were elephants close by, I left my cot and joined the people on the rocks in the bed of the river, but the only sound I could hear, was the rushing of the stream. I was as angry as people are who leave their beds so hurriedly, and to pacify my wrath, a man got up a herd of Bison on the other bank, where not a leaf was moving. This fancy picture did not take up our attention long, for the real cause of the alarm was close at hand, to set our doubts at rest. The trumpet of an elephant was heard within some twenty yards of us. The people shouted, and I fired my gun, aiming (now I think of it) in the direction of the noise, as if I had a hope my ball would go directly down the throat of the intruder. This did not move the beast, but a handful of dry leaves upon the embers of our bivouac fire sent up a blaze sufficient to alarm him, and we saw him move away, with most unsporting satisfaction. The elephant had come by a path parallel to the river bed, and when the first noise startled him, he must have stopped, and remained quite motionless ; for where he stood was close upon my writer's cot and within five yards of mine, the reeds we slept in being so thick we could not see him through them. It was a merciful escape for both of us. We placed our cots upon the open rocks for more security, and had no further interruption to our slumbers. The smuggler guide gave us a reason for the visit paid us that elephants were in the habit of frequenting halting places to eat the ashes left from the travellers' fires ; a wholesome practice doubtless, for after eating acrid leaves by waggon loads, it must be just as well to take a bucket full of potash now and then.

The position of this halting place is what would be called undoubtedly feverish, but from the account the smuggler gave me, it appears that with the exception of the northern edges of the Annamullays, there is very little fever in the jungle any where. This if true, is a most curious fact, as in denseness and confined positions it has all that suits our notions of "malaria."

The want of torches, and the elephants supposed to be on our

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line of march, obliged us to remain till daylight. At six we started, but half an hour was lost in finding where the ponies could get over. The river being formed of blocks almost square, with spaces between them one foot or so broad, and from two to four feet deep the most dangerous footing possible for horses; but favored here again we got over without accident, and were clear of the reeds on the river bank by half-past six.

The country we travelled through from this point is undulating, and the forest, like the generality of what we traversed yesterday, of fine trees with thick underwood. The soil rich, and the air in the shade cool and pleasant. The direction of our march was from east to north east, and the trees had all the fresh marks of the smuggler's knife till we had travelled an hour and thirty-five minutes at the rate of three miles an hour, at this point a path ran to the eastward, but the guide had doubts as to our horses being able to descend a pass to which it led. This pass is called the Kala Kumama; leaving this track we turned to the N. E. and had no longer the fresh knife marks on the road side. The path however, was well defined, and is evidently used by smugglers on some occasions.

We saw here the first teak we met with, and the forest belongs I believe to the Cochin State. At half-past eight, we halted for a few minutes on the banks of the Yeddapara, a considerable river, of indifferent water, about 2½ feet deep where we forded it. This stream was very unlike in character to the Oracumbum, and bespoke a more level country. The bed being sandy and the current slow. This water runs to the westward, like all that we have hitherto crossed, showing that we had still to turn the highest ground of the range. The underwood here is chiefly young bamboo from the seed, which by my guide's account has been in the ground about 9 or 10 years. The age at which the bamboo flowers, seeds, and dies, is very differently given, but it cannot be less, I believe, than 30 years. I have seen several jungles of this plant come to maturity and die, but till now I have had no opportunity of seeing the crop rising again from seed. A great extent of bamboo jungle at the foot of the Koondah ghaut died down four years

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ago, and three years passed without any appearance of the fresh plants. This year I have not examined the ground, but from this man's account, and the size of the plants in this locality, I am inclined to think, that the seed does not germinate for several years.

About 1¼ miles north of the Yeddapara we came upon the first glade we had seen since leaving Mallicatoor. This break in the jungle is covered with waving grass, and scattered trees, it is about ¼ of a mile in the broadest part, and extends nearly a mile. The soil is moist, and it is trampled by elephants and bison in every direction; a sounder of hogs crossed our path in this glade, the only game of any sort we had met with, except the solitary elephant at the Oracumbum river. As a general thing, the deep forests of the western coast give shelter to very few animals, and this the broadest belt of forest I have crossed, appears to have less than any; elephants seem to have almost sole possession of the Annamullays. Their tracks are to be seen every where, and though we saw so little of their recent traces, it is to be accounted for, by our path leading us along low ridges too dry for them, at this season, and not to their scarcity in the hills, for every single tree by the way side, which was of sufficient strength to bear the pressure, was covered with the mud that had been rubbed from their backs during the monsoon when they can find water every where and wander where they will.

The teak as we advanced, became the principal tree of the forest, and the growth is superb, far exceeding any thing now left in the district of Malabar. At half past 10 we came upon a strong party of men working for Mr. Gardiner and Gooroobucksing, two Palghat timber merchants, who, as I understand their workmen, are now cutting up and carrying away by permission of Government some teak which was felled here several years ago, when the jungle was supposed to belong to the Colungode Rajah, but which has since been claimed as British property. The facts of this case I am not acquainted with, and if I were, it is no concern of mine; I cannot however, on the plea of its being out of my own division allow to pass unnoticed, the wasteful manner in which this most valuable forest is worked; but I must preface what I have to say

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by stating, that I have no acquaintance with the working of Teak forests, nor any knowledge as to the terms upon which this timber has been purchased by those engaged in its removal; and my remarks if they are of any value, can only be so by leading to an enquiry as to what are, and what ought to be, the means adopted for saving to the utmost this most invaluable wood.

The jungle in which this Teak is cut is the most magnificent forest I have ever seen, in any country, for the straightness and height of the trees, as well as for their enormous girth. Those which have been felled vary in size from two feet in diameter to four, five and even six. Their growth in general is more like the American pine than the oak, as they have clear branchless stems of great length and a spreading head. The underwood is now burnt, as it is I believe each year, and every stem may be examined, as well as if it were lying in a timber yard.

As I rode through the forest in a direct line to save time, and avoid if possible another night in the hills without shelter I could only judge of what was doing, by what happened to fall in my way, but that was quite sufficient to show me, that five-sixths at least of this magnificent timber was totally lost. The order given to the wood-cutters is to send down planks of the following dimensions;* and the wood which is not suitable for cutting to that measurement, is abandoned to be burnt with the underwood, in the next dry season. The people receiving these instructions seem to consider their work done well, when they procure in a certain number of days, a certain number of planks, without the slightest reference to the number of trees expended in procuring them. They are furnished with axes only, and (whether by the timber merchants' permission or not, I am unable to say,) they save their labour with axe, as much as they are able by the use of fire. In the hurried view I had of the work it appeared that the length

* Ft.		Ft.	In.		In.
30	×	1	¼	×	4½
25	×	1	11¾	×	4½
20	×	1	10½	×	3½
17	×	1	8¾	×	3¼

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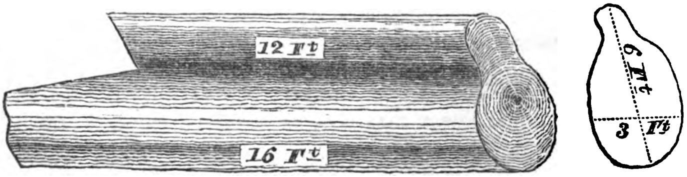
required for the first class plank was cut out of the stem, where it could be got with the least amount of labour which of course was at the sacrifice of the thicker part of the butt. To bring the timber into shape it is squared in some cases with the axe only, but in many others, it is chopped in notches, so that a fire being placed along the side, a flat face is given it by burning off the outer surface. Many whole trees seem to be lost by this process, and I should think that the timber saved was materially injured by the operation, as the heat must destroy much of that essential oil on which the durability of teak seems so materially to depend. The timber has now to be cut into planks by the axe, and it will not be difficult to imagine how much wood must be cut to waste before this is effected, even if care were taken to economize it. The space between the planks is at least as broad as the planks themselves namely six inches ; and in splitting them off, numbers are so much injured as to be unfit to send out of the forest. I saw the remains of one of these trees that was said to have yielded about 6 or 7 planks, which, with a saw, would have been cut into 15 ; and this statement of 6 or 7 appeared to be merely a guess of what would have been considered a good number to be procured from such a stem; including those which were split and useless. The butt of this tree which was abandoned was of the following dimensions.



In addition to this, the head of about the same length is left upon the ground, and both will probably be burnt when the jungle is on fire during the next dry season.

Whether the forests worked on account of Government are wasted in this reckless way or not I cannot say, but even if the same means are used, with every possible care, the loss must still be something enormous, and when I see that so great importance is attach-

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ed to the economizing of teak, that a regulation of Government forbids the cutting of trees under a certain girth, I feel sure that I am not writing uselessly in calling attention to this reckless waste.

I passed through no other fine teak forests belonging to the British Circar, but if I am correctly informed, this belt extends to the eastward, and the value of the timber within the Company's territory is immense. If such is the case, not one tree of teak should be cut, till some European officer of intelligence has carefully examined the extent and position of these most precious forests, and the best means are suggested for working them. But whoever undertakes this will have to give his undivided attention to the work for many months, as at present the hills are quite unknown except to the wild people who inhabit them; and the smugglers, and Moplah wood cutters, who want no change in the forest management.

Should the Company's forests be as valuable as I am told they are, they deserve immediate attention. The timber of the Annamullays, is evidently at its full growth, and loss of time in cutting will cause a clear loss of money. I would therefore recommend some suitable person being sent to the hills with instructions to enquire into the best means of cutting and transporting the timber, the most advantageous size for moving it with reference to the expense of carriage when compared with its liability to injury if reduced to too small dimensions, and also what extent of forest there is, that an estimate may be formed of the capital it would be advisable to sink for opening roads, erecting saw mills, &c. &c. &c.

With regard to the best means of removing timber, I am of opinion that such a road might be opened through the Annamullay hills, as would admit of very heavy timber being taken through them on wheel carriages. The streams which all flow to the westward could be turned to account for its conveyance, when the fall is not too rapid, and if it was found advisable to use machinery for sawing the same streams would afford the power for working it.

To work these forests with inefficient means, or let them to persons with small capital and no scientific knowledge, on terms which make the value of the timber wasted no consideration, is a sacrifice

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of all but a trifling portion of the Annamullay teak; and a loss of what in a few years money will not purchase.

A road from the southern Talooks of Coimbatore to Cochin would be of the greatest importance to that district, and do more for the port than any other improvement that could be suggested. It appears very probable also that on enquiry it will be found, that by opening a pass into the teak forests from the low country of Coimbatore, the same communication continued to the westward will serve both to lead the produce of Poolachy and Odamulla-cottah by a direct line to water carriage, and take this vast amount of timber to Cochin.

A road for timber, on which it would be necessary to move very great weights, should, I imagine, differ in one respect from the line which would be opened for general traffic. The slightest ascents should be avoided at some sacrifice of distance, but from the nature of the country I explored, and the gradual fall in the rivers I crossed, I am inclined to think that the road opened for the heavier timber carriages would answer well enough for other traffic, bringing the produce of the southern Talooks of Coimbatore within 70 miles of water carriage and little more than 100 of the port of Cochin.

From the teak forest I descended into the plain of Coimbatore by a pass opened for the transport of timber, and after riding 15 miles arrived at Annamullay soon after dark.

The distance we passed over, since leaving Malliatoor, calculated by time with a careful memorandum of the rate at which we moved is 57 miles; of which 53 are through an unbroken jungle. This would in most parts of my division be 53 miles of danger from fever, but here I really think the danger is very trifling. At Malliatoor (which at a distance has the character of being feverish) I found very little fear of deadly fever in the neighbouring forest. The smugglers declared to me that they did not suffer from it, although the greater part of them are coolies hired for the occasion and not at all acclimatized. The first I heard of fever, was on the side of Coimbatore where the people cutting timber had in the last few days begun to suffer from it.

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I had no means of ascertaining the height to which I ascended in crossing these hills, but my impression is that I was never more than 1,200 feet above the sea.

The smugglers at the Annamullays are more dreaded by the people of the neighbouring country than either the fever, or the wild beasts, which are usually the great cause of alarm to those who pass through the jungles of Malabar. In number they are formidable no doubt. I fell in with 60 in two gangs, and I believe that I did not see more than the average of a day at this season. On the second day I left their principal track, but I heard of their having passed in considerable numbers. They carry no arms, but slings, and the bamboo on which they occasionally rest their loads; and have evidently, from the reputation for ferocity they keep up on policy, and the nature of the country they traverse, little or no use for weapons of any kind. Nairs, Teers and Moplahs are all concerned in this trade, and it appears that a certain number of the latter are engaged with each gang, as a protection against the parties of that race which may be met with on the road. My Teer guide informed me that without them, a gang of his caste might very probably be attacked by one of Moplahs. My guide was a Teer, but the Nairs seem to be more generally the leaders of parties, and many of each gang are men hired for the occasion, who receive five per cent. of the tobacco as their hire. It is evident that men of capital in the open country are the leaders in the trade, and men of superior intelligence and daring do business with them as the heads of gangs, each having with him a certain number of men in whom he can trust. From the statements given to me by the smugglers, their profit is about cent per cent. on a trip which occupies eight days. They buy of course at a higher rate than the Sircar and sell it at a very much lower price. A cooly earns from 2 to 3 Rupees in a trip, according to the load he carries, and the luck he has in selling the bundles he receives as his hire.

The only inhabitants of the hills are, I believe, a quiet harmless race of people, who live without houses, but assemble in considerable numbers in the spot which suits them as a residence for the day or month. I was led to hope that I should see two or three

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hundred families on the banks of the Oracumbum, but I did not, as it chanced, fall in with any.

It was a great disappointment to me to see nothing of this wild race, who like the tribes that inhabit the mountain regions of the world in general, are in all human probability the first possessors of the plains. They have been fugitives from the invader of their country, too proud it may be, to bear the slavery they were threatened with: and contented rather to brave the miseries of the previously untrodden forest, than to take the place of menials to their conquerors. This well-founded supposition gives a peculiar interest to the people of the forest every where; and if the accounts of the "Kader tribe" are true, they have, after an unknown length of time passed in banishment from all that civilized man considers the commonest necessaries of life, still retained some of the finest feelings the human race can boast of.

Since writing the diary from which this abstract is made, I have had some intercourse with the wild people of the Annamullays, and my acquaintance with them enables me to bear witness to their many good and agreeable qualities. They are gentle in their manners, kind and courteous, and always ready to help the stranger who meets them in their forest. And if the shelter they have to offer is but indifferent, their hospitality is greater in proportion to their means, than that of more civilized races; for they will at any moment, and in any spot, build a new house for the travellers, and furnish it completely.

The little houses built on such occasions, are curious specimens of simple ingenuity. They are made entirely of twigs and leaves and grass; and there is not a stick in them an inch in diameter. Light straight wands are stuck in the ground, enclosing a space about 10 feet by 6. The sticks which are to help in forming the sides of the house are about 5 feet high, while the two which are to support the ridge of the roof may be 7 feet in length. Cross sticks are tied by strips of bark to support the uprights, and form a network for holding the leaves or grass which is to form the wall. The roof has gable ends, and is composed like the sides, of cross

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sticks tied together with some of the fibrous barks which seem always to be at hand.

The roof is of leaves, teak leaves being preferred when they can be had. These are laid on like tiles, and as it appears to me they only stay there because their friends the Kaders wish it. It is true that in these dense forests the wind is little felt; but if an Engineer staked his credit upon such a roof, I am perfectly certain that neither his person nor his character would have a square inch to shelter under. The thickness of the roof and walls could not be one quarter of an inch, and the whole material of a house would not be considered a load for the feeblest old woman who picks up sticks to boil her kettle with.

I lived in huts of this kind with my friend Mr. Michael when we were examining the forests, and spent many days in them during the S. W. monsoon when there was constant rain. I will not say that these dwellings were altogether water-tight; but the roof being within reach as we lay upon our beds, we could always with the point of our fingers slip the leaves that were out of place into their right position, and stop the leaks that troubled us.

The furniture of these little houses consisted of a bed-stead, and if required, a table. Both were made by sticking stakes into the ground and tying sticks across, so that a plank or mat might rest upon them; but as planks and mats were not always at hand, the surface of the table or bedstead was formed from a thick bamboo. The Kader holding it with one end resting on the ground, slashed round each joint, driving his bill-hook lengthwise into the bamboo. When this had been done round every knot and joint, a cut down one side of the bamboo laid it open, and it flattened out and formed a strong and elastic mat (if it may be so called,) admirably adapted to support the bedding. Each of these was about 18 inches broad, and two were more than sufficient for a single bed, where such sleep was to be had as we found in our Annamullay wanderings.

One of the characteristics of the Kader was always said to be his love of truth and so we found it on an acquaintance; although on one occasion our faith in it was somewhat shaken; when seek-

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ing for information as to a line of boundary, a man of one Kader tribe stood upon a rock, and looking to the dark cloud overhanging us, wished that the lightning might strike him to the earth if that was not within *his* range of forest; and on his leaving the slab of stone another man as earnest in his manner and as wild in gesture, stood on the self-same spot and called the flash to settle the disputed point by smiting him if he was not within his own tribe's limits. It was difficult to reconcile these counter statements; but it was probably a point that had been fought for from the earliest time.

The Kaders do not cultivate but live much on the roots and fruits the jungle yields spontaneously. They do however obtain grain and cotton cloth by barter with the people of the plains, which they pay for in wild ginger, turmeric, bees-wax and gums of different kinds. The mention of bees-wax calls to my recollection a conversation that astonished me not a little. At the time it passed, we were looking at some cliffs in the deep forest about 300 feet in height, against the face of which where reared bamboos with the branches so cut off that they left an inch or two to rest the foot upon, and thus formed simple ladders, not altogether easy to use by the uninitiated because being single sticks they turn round under the weight of those who climb them; but these were Kader staircases, and the use they made of them was most astonishing. By means of these bamboos raised from ledge to ledge, the wall of rock was gained step by step, and where the cliff overhung, the ladder was tied by twisted bark so as to bear the climber's weight. It was a marvel how they got the bamboos to the ledges that supported them; but when I asked the little man who led me through the forest how, after they had got the ladder in position, they could take the combs from the bees that with their vigorous attacks had driven us from the summit of the cliff the day before, he began his story by saying "We wait till there is no moon, and take the darkest night." Imagine the nerve required for that.

These little dwarfish people file their front teeth into points, to facilitate their eating the hardest roots. There is some nerve shown in this too, and we may look with wonder and respect upon the

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exiled lords of the ancient land, when we see that rather than serve those who usurped the country they chose to live where the food was beyond their natural powers, and could be eaten only by such a preparation of their teeth. It is possible that in the absence of better arms they reckoned upon these pointed teeth as weapons in case their conquerors should follow them to their mountain home.

I must say a few words as to the consequences of this short excursion in the Annamullays. As it so happened that in 1847 the Coimbatore district was taken within the limits of my range as Civil Engineer of the 7th Division, the Government offered to place means at my disposal for working the forests on the public account. This I did on being allowed to select Lieut. Michael of the 39th Regt. as the Executive Officer. Mr. Michael undertook the work, and carried it out with great energy. The saving in the cost of teak timber has been very considerable; and although it has not been found practicable to substitute the saw for the axe in the preparation of the planks used in ship building; there has not been that reckless waste which characterized the working of the forest formerly.

One good effect of Lieut. Michael's labors in the hills has been the emancipation of the hill people from those who rented the wild products of the jungles, and had the monopoly of all that was brought out of them for barter. This monopoly led to the Kaders being in a state of dependence upon any low country shopkeeper who offered the highest rent for the year. And it may be supposed that under such circumstances they had but an indifferent market for the produce of their labor, while cultivation on their own account was strictly forbidden by the renters.

Mr. Thomas, the Collector of Coimbatore, availing himself of the presence of Mr. Michael in the hills, obtained the sanction of Government for his being invested with the powers of a Magistrate and the discontinuance of the renting system; and thus gave the Kaders freedom either to cultivate or trade, and to dispose of their products to those who offered them the best price.

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I wish I could add to this very favorable change in the state of the Annamullays, that it was no longer the resort of smugglers, but unfortunately the Native States of Travancore and Cochin have not yet followed the liberal policy of the British Government in sacrificing the profits of the Tobacco Monopoly to the moral well-being of the people.

SELECTIONS.

New Cinghalese Plants.

No I.

We now proceed to avail ourselves of the permission accorded to us by Mr. Thwaites* to republish the new Plants discovered by him, in the Island of Ceylon and contributed to the Kew Miscellany.

The two following plants occur in Vol. IV. page 1, of that valuable and interesting publication.

The first of the two is a new species of an already established genus. *Epicarpurus*, one of the group of BATIEÆ which after having been included among the EUPHORBIACEÆ has now been rightly transferred to the natural family of URTICACEÆ. The BATIEÆ are well represented in Southern India by *Batis spinosa* of Roxburgh, common in the N. Circars under the name of *Gorati* or *Koriti; Epicarpurus orientalis* (*Trophis spinosa* Roxb.) Telugu name, *Sitanica;* and *Trophis aspera* frequent in all parts of the Carnatic, in Telugu *Barinika*, in Tamil *Piraya*. To the same group also belong the celebrated cow tree of the Caraceas, *Galactodendron utile* or Palo de Vaca of Humboldt and the Jamaica bread-nut tree, *Brosimum Alicastrum*, Sw.

The Indian congeners also abound in a milky juice but it does not seem to be turned to any economical purpose, except in the case of *Trophis aspera*, the juice of which is sometimes mixed with cow's milk and heated to cause it to curdle. Its leaves are employed as a polishing agent by workers in ivory. W. E.

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* Journal Vol I. p. 283-4, Proceedings of March 12, 1857.

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On two new Plants, EPICARPURUS ZEYLANICA *and* DOONA ZEYLANICA, *found in Ceylon; by* G. H. W. THWAITES, ESQ., *Director of the Botanic Garden of Peradenia.*

EPICARPURUS ZEYLANICA, *Thw.*

Frutex ramosus, foliis subrhombeo-lanceolatis acuminatis glabris remote spinuloso-serratis, floribus masculis dense capitatis, capitulis oblongis, fœmineis racemosis, pedicellis apice incrassatis fructiferis valde elongatis.

A *shrub* or small *tree,* eight or ten feet high, sparingly spinose, much branched; the extremities of the young branches with a few short scattered hairs. *Bark* dark brown, somewhat rugose. *Leaves* smooth, flaccid, lanceolate or rhomboido-lanceolate, serrated, one and a half to two inches and three-quarters long, by three-quarters to one inch wide, tapering towards the slightly hairy very short petiole, with glandular puncta very minute and numerous. MALE INFLORESCENCE pale yellow; anthers nearly round, with a green spot on the back; *bracts* small, inconspicuous. *Sepals* membranous, obtuse. FEMALE INFLORESCENCE: *flowers* green, on rather long pedicels; *sepals* acute. *Stigmas* with brown villi on their inner face.

The male of the species just described bears a considerable resemblance to *Morus,* and might easily be mistaken for a member of that genus, but it will be seen that the structure of the female plant differs essentially from that of *Morus.*

The ovule in this plant, which at first merely causes a slight protuberance on one side of the ovary during its development forces itself out of it, as it were, and at last occupies the summit of the flower having pushed the upper part of the ovary with the stigmas on one side. It then has the appearance of a naked seed seated upon an enlarged receptacle.

The Peradenia Herbarium contains another species of the genus, allied to the above, but differing in its more rigid habit; the branches, which are of a pale ash-colour, all terminating in spines. The young male inflorescence differs too in being enclosed in rather large brown scaly bracts; and, in the only specimen of the female

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plant I have seen, the sepals are large and leaf-like, completely covering the fruit. (It is probably *Trophis spinosa*, Roxb.—Epicarpurus Timorensis, *Dcne.*) *Thwaites.*

We are indebted to Dr. Arnott for the following notes on the genus *Epicarpurus* and its allies :—

Blume, in his Bijdr., p. 488, has established the genus *Epicarpurus* for a plant he calls *E. orientalis*, and for which he cites Rheede, Hort. Mal., vol. i. t. 43 ; this last is universally allowed to be *Trophis aspera.* Blume, in the edition I possess, and the only one I ever heard of, gives us no information as to the relative size of the two cotyledons; but M. Decaisne, in his 'Herb Timorensis Descriptio,' p. 171, says, "M. Blume indique, dans son *Bijdragen*, les cotylédons de son *Epicarpurus* comme étant inégaux." In the *E. Timorensis*, which Decaisne describes and figures in that memoir, the cotyledons are represented unequal, but he adds that in "*Trophis aspera*, Wall. L. n. 4,640," the cotyledons are foliaceous and equal.

I do not know precisely what plant M. Decaisne had before him, but in all that I have examined under the name or similitude of *T. aspera*, the cotyledons are nearly as described by Roxburgh in his Flor. Ind. vol. iii. p. 761, and represented in a drawing in the E. I. C. Museum, tab. 118, viz., "cotyledons two, very unequal, the largest being nineteen-twentieths of the whole embryo, and one side divided *half-way through into two lobes*: the small cotyledon is hid between the lobes of the larger one." If M. Decaisne has, from its smallness, overlooked the one cotyledon, and mistaken the two lobes of the greater one for two equal cotyledons, the difference between his, Roxburgh's and my observations will be accounted for. At all events, I consider that *T. aspera* (and so marked is that species that I have seen no other confounded with it) must be held as the type of *Epicarpurus* of Blume.

In his 'Bijdragen,' p. 507, Blume suggests that his *Urtica spinosa* is another species of *Epicarpurus:* Decaisne adds *E. Timorensis*, and says that *Albrandia* of Gaudichaud also belongs to it. Gaudichaud's character of *Albrandia*, in Freycinet's Voy. p. 709, is too

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imperfect to permit me either to affirm or deny this, and I have seen no specimens; but all the species with which I am acquainted, either by specimens or figures, are furnished with thorns and smooth leaves, except the original species (*Trophis aspera*): in all, except it, the ovary undergoes an unequal development, the side to which the ovule is attached enlarging more rapidly than the opposite one; so that the style, which at first is at the apparent as well as real apex of the ovary, appears at length lateral, and the ovule becomes more elevated than the base of the style.

The original and genuine species of *Epicarpurus* scarcely exhibits any tendency to this kind of resupination, and has no spines. To the spinous section I refer *Trophis spinosa,* Roxb. Fl. Ind. vol. iii. p. 762 (*T. taxiformis,* Hook. et Arn. in Bot. Beech. Voy. p. 215, or *T. taxoides,* Roxb. in E. I. C. Mus. tab. 120, and in Roth, Nov. Sp. p. 368), *Epicarpurus Timorensis,* Dcne., which scarcely differs as a species, unless characters not alluded to in the description and figure can be derived from the specimens, and a Ceylon species, from Mr. Thwaites, lately submitted to my inspection, in which the perianth of the female flower does not seem to enlarge with and at length conceal the fruit, in that respect resembling more the genuine *Epicarpurus,* while the foliage and fruit are those of the spurious group. All these have the female flowers solitary or nearly so, and the males in globular heads or very short nearly globular racemes; but if there be no mistake in Blume's work, his *Trophis spinosa* has the flowers spicate (at least his generic character indicates this), and his short description of *Urtica spinosa* seems to indicate the same structure.

Epicarpurus microphyllus, Raoul in Ann. Sc. Nat. ser. 3. vol. ii. p. 117, and Choix de Pl. Nouv. Zélande, p. 14. t. 8, has the male flowers in bracteated spikes or rather catkins, and the female as in *Epicarpurus orientalis,* but the embryo is described "cotyledonibus conduplicatis *æqualibus* plicatis foliaceis." Raoul adds, "Notre *Epicarpurus microphyllus* appartient bien au genre où je l'ai classé par forme de ses cotylédons: les *Trophis* ont les cotylédons charnus et trés inégaux, tandis que dans la plante qui nous occupe ils sont chiffonnés et foliacés." Were the only difference between *Trophis*

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and *Epicarpurus* to consist in the proportion of the cotyledons, I fear that they must be again united: in *Epicarpurus* the cotyledons are often thick, but they are constantly folded and crumpled. Of the *Trophis Americana,** which is the type of the genus *Trophis*, I have not examined the seed, nor does M. Trecul (Ann. Sc. Nat. ser. 3. vol. viii. p. 147) describe it; but there are abundant marks of distinction in the spicate inflorescence and tubular perianth.

Trophis and *Epicarpurus* both belong to the *Moreæ* as characterized by Trecul, the stamens being inflexed during æstivation.

In Trecul's memoir alluded to, an error occurs as to *Trophis spinosa*, Roxb. This I have said is one of the thorny species of *Epicarpurus*, and almost identical with *E. Timorensis* of Decaisne, as every one must acknowledge who reads attentively Roxburgh's description (Flor. Ind. vol. iii. p. 762); but Trecul refers it (p. 123) to *Cudrania Javanensis*, a plant belonging to his *Artocarpeæ*, having the female flowers in dense capitula, arranged in umbels, and with a simple style. In this he has been, perhaps, misled by Blume, who, in his 'Bijdragen,' p. 489, appears to have described a species of *Cudrania* (probably *C. obovata*, Trec.) under the name of *Trophis spinosa*, Roxb. Indeed Roxburgh himself may have led others astray, the plant to which he gave the manuscript name of *Trophis spinosa* at an early period of his botanical career, and under which he deposited a drawing in the E. I. C. Museum (tab. 119), and which name was adopted by Willdenow, never having been published by him as such: in fact, his manuscript *T. spinosa*, and consequently the *T. spinosa* of Willd. Sp. Pl. vol. iv. p. 735, is the *Batis spinosa* of the 'Flora Indica' (vol. iii. p. 762); nor is *T. aculeata*, Roth, Sp. Nov. p. 368, at all distinct: this, although belonging to the *Moreæ*, has the habit of *Cudrania*, and is the *Plecospermum spinosum*, Trec. (l. c. p. 124). So far as I can ascertain, the *Cudrania Javanensis*, Trec., was unknown to Roxburgh, although

* *Trophis Ramon* from Mexico (Linnæa, vol. vi. p. 357) is scarcely distinct. The specific name, too, is unfortunate, being obviously the same as *Ramoon*, by which *T. Americana* is known in Jamaica. *Ramon* is a Spanish expression for small boughs or twigs, which, when broken off, are suitable as fodder for cattle, and it does not indicate the species of plant.

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I feel satisfied that the other species placed by Roxburgh in *Batis* (*B. fruticosa*) is referable to *Cudrania.*

M. Trecul states that the specimens received by M. Delessert, and at the Paris Museum, from Dr. Wallich, under No. 4641 of his list, belong to two different genera; M. Trecul adds however, that these specimens were from Nepal. Now herein, I believe, is some error; for, although *Cudrania Javanensis* be found in Nepal, I have reason to suppose that *Plecospermum* is not, and consequently that there must have been some mixture of labels; indeed, from the rapidity with which Dr. Wallich distributed the large collection under his charge, he could not overlook every specimen, but was obliged to leave much to those friends who assisted him. As M. Trecul does not state the *letter* attached to the specimens, I have no means of checking the error, but shall here state in detail the result of my own examination of most of the suite of specimens reserved for the India House, and now belonging to the Linnean Society of London.

4641 A, Herb. Heyne, from the Peninsula, is *Plecospermum spinosum*, with some specimens accidentally mixed of *Pisonia aculeata.**

B, from Nepal, appears to be *Cudrania Javanensis*, but the specimens are bad; this species, however, is to be seen in various herbaria from Nepal, collected by Dr. Wallich, in 1822.

C, Rohilcund. (On this I have no notes.)

D, from the Hort. Bot. Calc., is *Cudrania Javanensis*, with one piece of *Plecospermum spinosum*. The former was introduced from Nepal into the garden by Dr. Wallich, and the latter from Coromandel by Dr. Roxburgh, in 1802; consequently both, being cultivated there, may have got mixed by those who dried them; but it rather appears to me that

* In the Linnæan herbarium are two specimens, one marked by Linnæus *P. aculeata*, the other, with smaller leaves, is unnamed by him but marked by Sir J. E. Smith *P. mitis*, L. This last agrees with the specimen mixed with Wall. L. 4641 A, but not with Linnæus's description of *P. mitis*, of which, however, he had no specimen.

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the specimens of *Plecospermum* belonged to the letter E, from which packet they had dropped out, and that they were not derived from the garden at all; at the same time I may state that in some herbaria specimens of *Plecospermum* only are to be found under the letter D: it is readily recognized by the paler, almost livid and obovate leaves.

E, from the Peninsula (Herb. Wight), is *Plecospermum spinosum*.

F, from Taondong. On this I have no notes; but if my recollection be correct, both C and F are species of *Cudrania*.

I may here add that of Wallich's List,

No. 4642, or *Trophis Heyneana*, is *T. spinosa*, Roxb. Fl. Ind., or *T. taxoides*, Heyne and Roth, and is therefore a species of *Epicarpurus*.

4643 A, or *Batis fruticosa*, is *Batis fruticosa*, Roxb., but is a species of *Cudrania*.

B seems somewhat different.

Morus? scandens, Wall. L. n. 4652, is the same as *M. Javanica*, Blume, Bijdr. p. 488, and *Trophis scandens*, Hook. et Arn. Bot. Beech. Voy. p. 214, and is a species of *Malaisia*, a genus of *Moreæ*, closely allied to *Trophis*, but perhaps sufficiently distinct by the number of stamens.

To sum up these remarks:—*Trophis spinosa*, Roxb. Fl. Ind. (and the only plant intended by him under this name in his published works), is an *Epicarpurus*. *T. spinosa*, Roxb. MSS., and of his earlier collections, as well as of Willdenow, or *Batis spinosa*, Roxb. Fl. Ind., is *Plecospermum spinosum* of Trecul, to which also *T. aculeata* of Roth must be referred, which is truly a Coromandel plant, and not from Nepal. *T. spinosa*, Wall., from Nepal, is *Cudrania Javanica;* to which genus *Batis fruticosa*, Roxb., and several species from the islands to the east of India, belong.

I have only to add that in the fifteenth volume of the Linnæa, Spanoghe, in his Catalogue of Timor plants, enumerates, at p. 355, "*Trophis spinosa*, Roxb.," and "*T. coccinea*, Zp.:" notwithstanding

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that he strangely refers these to the *Thymeleaceæ*, leaving doubts even as to their affinities, I am inclined to think that both are species of *Cudrania*, and probably both described by Trecul.

DOONA ZEYLANICA, *Thw.*

Nat. Ord. DIPTEROCARPEÆ.

CHAR. GEN.—DOONA, nobis.—*Arbor* ingens, resinifera, versus apicem ramosissima. *Folia* alterna, stipulata, vernatione conduplicata, nec plicata; *stipulis* binis deciduis. *Calyx* persistens, 5-partitus, in æstivatione contortus; *sepalis* duobus interioribus minimis, tribus exterioribus majoribus crescentibusque. *Corolla* 5-petala; *petalis* ad basin connatis. *Stamina* 16, bi-seriata; *filamentis* dilatatis ad medium connatis; *antheris* subquadratis introrsis, longitudinaliter dehiscentibus, singula claviculo dorsali instructa. *Ovarium* superum, 3-loculare, loculis 2-spermis; *ovulis* semianatropis pendentibus. *Stylus* simplex, curvatus. *Stigma* simplex. Inflorescentia *ad apices ramorum, paniculata;* paniculis *axillaribus terminalibusque.*

Doona *Zeylanica.*

A *tree,* sixty feet in height and upwards, with a single *trunk,* much branched towards the upper part. *Bark* rough and cracked. *Branches* terete, smooth. *Leaves* petiolated, flat, penniveined with very numerous intermediate reticulations, lanceolate, 2-2½ inches long and ¾ of an inch wide, dark green above, paler beneath, rounded at the base, tapering towards the apex into a rather long acumen with an abrupt point. *Petioles* ½ an inch in length, grooved along the upper surface. *Branches* of the panicles pale, jointed, with small brown deciduous *bracts. Calyx* pale green, tinged with red, the three enlarged leaves becoming of a deeper red colour. *Petals* pale rose-colour, darker at the tips. *Stamens* with white dilated *filaments,* which are united more than half-way up. *Anthers* yellow, with a dark red dorsal claviculus. *Ovary, style,* and *stigma* pale green

This fine forest-tree is very abundant in some parts of the Central Province of Ceylon, especially on the crests of the hills; the

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timber is much esteemed for building purposes, and the resin which exudes in considerable quantity from any wounded part of the tree is sometimes used by the natives for burning in their houses, being first mixed with the husks of paddy. The resin is soluble in spirits of wine or turpentine, and makes an excellent varnish.

The tree is called by the Cinghalese "*Doon*," or *Doon-gaba;* anglicè, *Doon* or *Doon-tree;* whence our generic name *Doona.* (The genus is nearly allied to *Hopeaa.*—ED.)—*Kew Misc. vol. IV. p.* 1.

In a subsequent volume, the following character of the embryo is added:

Embryo Cotyledonibus, foliaceis, valde inequalibus; harum maxima inter stratum oleoso-albumenosum contorto-convoluto, in germinatione inclusa; altera brevissima, in germinatione sæpissime emergente.

This shows the genus *Doona*, Thw. to be very distinct from *Hopea*, Rox. t., the Cotyledons of which, like those of *Vatica*, L. are subequal, very fleshy, and emergent in germination.

Seven species of *Doona* have now been detected in Ceylon.—*Ibid*, viii. 377.

Observations on Free Labour Cotton of Honduras and Yucatan, in the West Indies, and of Western Africa, and Natal; also, Relative to East Indian, and Slave Grown Cotton of the United States, by JAMES BANKS, *late of Honduras.*

Extracted from the "TRANSACTIONS of the SOCIETY of ARTS," for 1847-8.

My friend Dr. JAMES THOMPSON, having submitted to the Society a sample of the common indigenous Cotton of Yucatan, on the Gulph of Mexico, and of the fine Anguella sort from British Honduras, for the purpose of showing the valuable qualities that might be obtained from these quarters by free labour, I was induced to present several samples, collected by me in that Settlement; and, at the suggestion of your Committee, the following observations are thrown together:—

The importance of our Cotton Manufactures; the successful

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competition of the American white and gray fabrics with those of Britain in foreign markets; the great production of the raw material by slave labour in the States; the general inferiority of that imported from India; the practicabilty of obtaining larger supplies by free labour from other quarters within our reach; the improvement of the staple and consequently of the fabric; and the opening of new markets in Africa and elsewhere, will be the subject of the few accompanying remarks, but which deserve more attention than the writer has been able to devote to them.

AMERICAN COTTON, QUANTITIES, VALUES.

The Honorable Levi Woodbury, Secretary of the United States Treasury, and Speaker of the House of Representatives, in a letter on the cultivation and foreign trade of Cotton, states that:—

The Cotton crop of the United States in 1835 was estimated at 480,000,000lbs. weight; which, computing 300lbs. to the acre, would give 1,600,000 of acres, and at 250lbs. per acre, 1,920,000 acres cultivated for Cotton.

Value of land 2,000,000 acres at 20 dollars per acre, about £4 Sterling, is 40,000,000 dollars, or about £8,000,000 Sterling.

340,000 field hands, (that is slaves) supposed to be employed, estimated then at 800 dollars each is 272,000,000 dollars, being £54,400,000 Sterling; also 340,000 assistants, estimated at half-price.

Total capital invested in theUnitedStates, in the production of cotton, estimated at 800,000,000 dollars, being £160,000,000 sterling.*

The quantity in the year 1834-5, was 1,254,000 bales, of about 350 to 400 lbs. each, in 1842-3 it was nearly double, or 2,378,000 bales;† so that the total investment in the cultivation of slave grown Cotton in the States will be now nearly £300,000,000 Sterling.

Of the unfortunate system of slavery, which Britain left in her former American plantations, the principal supports are Cotton, Tobacco, and Rice. Out of 113,000,000 dollars of domestic ex-

* See Tables and Extracts from said Letter in American Almanac for 1837, page 93.

† Cotton crop of United States for 1843.

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ports in the year 1840, the then value of cotton was 63,000,000 dollars: being £12,600,000 Sterling.

Tobacco, 9 to 10,000,000 dollars ; being £2,000,000 Sterling.

Rice under 3,000,000 dollars;* being £400,000 Sterling.

Of above 2,000,000 bales of American Cotton exported in 1842-3, Britain took nearly 1,500,000 bales; France below 350,000 bales; other foreign countries less than 200,000 bales. Of the growth of that year, which was 2,378,000 bales, the American manufacturers consumed 325,000 bales, or nearly as much as was exported to France. Of Tobacco,† Great Britain and the Colonies took one-third in quantity, but nearly one-half in value, in the year 1835; so that England may be said to employ three-fourths of the American slaves engaged in planting Cotton and half to a third of those who cultivate Tobacco for export. It becomes therefore, a national obligation on our part, to study every means by which those products may be obtained by fairly paid labour.

Our supposed dependance on the " Great Staple" of America is thus expressed in the *Times*, (30th Oct., 1845,) in an article from the Washington Union—of which the following is an extract " The " English experiment in the East has signally failed. It was made " under the most favourable auspices in different parts of India. " It has succeeded in none of them. It was made under the eye " of ten experienced planters from the cotton regions of the United " States with the best American cotton-seed; but it has failed! " Nature forbids any serious competition between the cotton of the " East Indies and that of the United States. The Southern portion " of our country stands unrivalled in the production of a staple " which constitutes the basis of the most important manufacture " both in Great Britain and on the continent. Britain would have " attempted to make herself independent of the United States, " throwing her own manufactures into Texas, upon terms that

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* "Exports of United States, produce for 1840"—American Almanac for 1842, page 118-9.

† Made up from Table of Tobacco Exports, in American Almanac 1838, page 125.

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"would have defied the competition of our own fabrics; and re-"ceiving the raw material in return, upon better terms than she "could have obtained the growth of our own Southern cotton "lands. The ACQUISITION of Texas, therefore, makes her greatest "interest (the most important branch of her manufacturing system) "dependent upon us. In the same proportion, of course, it gives "us every advantage in competition with her. The ACQUISITION "of Texas thus puts us in possession of almost all the best lands "in the world for the growth of cotton; and this is decidedly one "of the most important staples, in every respect, than can be cul-"tivated by man. If we do not hold the monopoly of the article, "yet we produce it of better quality, and in greater quantity, than "any other country. Thus it becomes an unfailing source of "wealth and abundance—of prosperity in peace, and of power in "war." This assertion brought several communications to the *Times*, and *Manchester Guardian*;* from which it appeared that, though the American seed had generally failed, from excessive drought or neglect of local irrigation, yet it had succeeded in several districts, especially at Dharwar; was progressing among the natives; that the American Saw Gin had been advantageously applied, giving all the benefit of celerity, cleanness, and superior

* London *Times*, 30th Oct., 6th and 10th Nov., and 26th Dec. 1845. *Manchester Guardian* of the 27th Aug., 8th Nov., and 6th Dec. 1845. The *Manchester Guardian* of the 1st Jan. 1842, and following, has a valuable letter from the Chamber of Commerce at Bombay, on improving Cotton cultivation of India.

*** Since the above communication was made to the Society of Arts, much valuable information has appeared in the Public prints, &c.

Besides the Parliamentary Report of 1848 on the Growth of Cotton in India, two articles in the Manchester Guardian of 5th June, 1847 from the "*Bombay Telegraph*," and the "*Calcutta Englishman*," would show our friends of the Washington Union that supplies of free grown Cotton from American Seed are far from a hopeless attempt. If restrictions on Land, and internal commerce are removed in the forthcoming renewal of the East India Company's Charter; the progressive opening of Railways through the three Presidencies, may persuade our transatlantic customers that successful competition in Cotton will be soon maintained by Free Labour; and Great Britain is morally and pecuniarly interested to encourage the United States by every fair compensation to a like attempt.

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quality; and so much had the native manufacturers preferred it that little had reached Lancashire.

A deputation from the Manchester Commercial Association having waited on the Directors of the East India Company, 5,000 bales of the best and cleanest cotton from American Seed were to be purchased, and shipped to this country, that English Spinners might have an opportunity of testing its qualities, in comparison with American Growth.

Thus has the American Saw Gin been advantageously applied in India; and it may also be applied in Tropical Africa, where indigenous cotton exists;—or wherever a favourable climate admits of the seed being cultivated; for it is upon the power, continuous motion, and expedition of the Saw Gin, accompanied by the Screw Press for baleing it, that free labour must depend for success; and, where the more productive climate of the Tropics affords so much larger returns than more temperate regions, there is every reason to expect successful competition with slave labour.

ROLLER AND SAW GINS.

A short explanation of the Roller and Saw Gins may enable their application to be better understood. The Roller Gin, commonly used in India, consists of two pieces of round hard wood, about ½ to ¾ of an inch in diameter, fixed horizontally into an upright frame, and turned by an endless screw, or oblique cogs, by means of a crank-handle; so that any cotton presented between the two rollers is drawn through, and the seed not being able to pass, flies off. It so happens, however that the cotton of one seed gets entangled with that of another, especially if small, (as some of that of India is), whereby some seeds get pulled through, mixing with the wool, and staining it from the oil crushed out by the pressure. This process is slow, and drags much of the dirt of the field along with it; though it is supposed to hurt the staple less than the Saw Gin. A model of this Roller Gin may be seen in the East India Company's Museum, among those of oriental implements. When seeds are covered with a thick down, the process is too slow to allow even fine cotton to be freed from the seed by

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the Roller Gin: and till Whitney's Saw Gin was invented many fine and long stapled but downy seed-cottons were abandoned by planters.

The Saw Gin consists of a number of circular blades of iron, with teeth of about $\frac{1}{8}$th to $\frac{1}{4}$th of an inch long set round a wooden cylinder, at about $\frac{3}{8}$ths of an inch distant from each other;—the cylinder in the HAND Saw Gin is moved by a small wheel and pinion: the Saws just pass so far between the bars of an iron grating, against which the cotton-seed rests, as to catch hold of the wool and pull it through the bars, leaving the seeds to revolve till completely cleaned.

The cotton is swept from the Saws by a revolving fanner; on each arm of which a line of hair brushes is fixed, or any other substance, (such as Spanish broom) that will effectually remove the cotton before it can be again carried through the grating. When these brushes are neglected the cotton gets cut, and its long staple injured; they should, therefore, be often examined and replenished. The cleaner, lighter, and longer stapled cotton is blown to the distance of some yards behind the Gin, if there is space; the heavier and most dirty falling immediately at the back of it. Thus two qualities may be obtained from the same cotton, at the same time. The fanner above mentioned is kept in motion by means of a band and pullies, connecting it with the wooden cylinder. By the Saw Gin any seeds, however difficult to clean by the Roller Gin, are swept clear of almost all the cotton on them; and its operation is so expeditious, that while a man will not pick more than 2lbs. of wool per day by the hand,—by a small Saw Gin of eighteen saws he will clean from 50 to 70lbs. The same Gin, driven by steam, or other power, will clean 300lbs. per day.

The Roller Gin, propelled by the foot, like a turning lathe, and used in Demerara, formerly required the labour of seven days turning, besides six persons cleaning, to obtain 300lbs. Dutch weight; thus giving only 23lbs. per man, and with very hard work. By the aid of cattle, a saving of eight or nine days labour was effected and with very easy work for the people employed; four well grown cattle being sufficient to furnish from 900 to 1000lbs. per day

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The Roller Gin is still used for finer Sea Island Cotton, which would be injured by the Saw Gin. I am told, that the Saw Gin has been improved by a mechanic in the service of the East India Company, from whom he has received a pecuniary acknowledgment for the improvement. An American gentleman, now in this country, has patented a different mode of cleaning, with all the celerity of the Saw Gin, without injuring the staple; not only removing the seeds, but even the small motes which weaken the thread and render the web rough and irregular.

SCREW PRESS.

The other essential Implement to enable African or other Cotton to compete with American is the Screw-Press. By compressing the wool into a compact and square, instead of a bulky and round bale, it can be brought at a freight of one farthing to one half-penny per lb. which, otherwise, could not be shipped here under one penny or three half-pence per lb.

The cotton is thrown into a square box, and by means of a screw it is pressed upwards against a beam, where the compactness of the bale is secured by ropes previously arranged.

CLEANING COTTON FROM DIFFERENT KINDS OF SEED.

It is of importance to attend to the seeds being covered with a thick down, or comparatively bare, and free from down. When they are covered with a close adhesive down, however fine may be the staple of the surrounding Cotton, the seeds are so difficult to clean by the best Roller Gins as to make the article unremunerative; when the fine sorts are cleaned by the Saw Gin, they may be torn and so reduced to the better qualities of New Orleans or Egyptian, worth from 6*d.* to 8*d.* per lb.

If the seed is of the fine stapled sort, and bare of down, then the Roller Gin may be employed, as injuring the fibre less than the Saw Gin; of this kind is the American Sea Island, which, when so cleaned, brings 12*d.* to 18*d.* per lb. The Anguilla and some of the indigenous sorts of British Honduras, comparatively bare of down, could be advantageously cleaned by the Roller Gin, and are considered to resemble Sea Island. Hand picked samples

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have been valued from 10*d.* to 15*d.* and 18*d.* per lb., and Anguilla, from 18*d.* to 2*s.* per lb. The clustered seed of Honduras, (supposed the Kidney seed of Brazil,) is a strong and long stapled cotton, but not fine; the seed is almost bare, is very easily cleaned by the Saw Gin, and, from its adhering together instead of being in detached seeds, is easily picked from the tree, getting less mixed with the Cotton leaves, which prove a detriment to the East India Cotton. The Kidney sort is remarkably hardy in the Tropics, and grows every where, whether near the sea or far inland. The writer had some of both these Honduras sorts cleaned by the Saw Gin, and sold by Messrs. Ewing and Co., of Glasgow, in 1841. It was disposed of at 6*d.* per lb., in order to get its spinning quality tested. The Kidney, and some stained Sea Island were reported as adapted for mixing with ordinary quality of Orleans Cotton for No. 60 to No. 64 weft; the other native Honduras seed, of a finer fibre, but also Saw Ginned, was considered fit for mixing with fair American Bowed, or Orleans for No. 70 to 80 weft: the value of the first on trial was stated at 6¼*d.* and of the latter at 6¾*d.* per lb.; or at one farthing, and three farthings more per lb. on trial than was paid for it; these prices being then equal to, or better than those of the best New Orleans. From a little of the Anguilla, grown in Honduras, it seemed to thrive near the sea, and was reported from hand picked samples, to be fit for making the finest Nottingham Lace. It was the original of the American Sea Island, having been sent from the West Indies by some Royalist Emigrants to their Republican friends after the American Revolution.* Though still of a fine sort, this kind has evidently become coarser, and the seed larger than the parent Anguilla. The Anguilla is entirely bare of down, and would be easily cleaned by the Roller Gin. It, however, yields only 17½ per cent. of wool from the Seed Cotton; while other kinds give about 25 per cent. of their weight shortly after being collected, but more as the seed becomes dry.

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* Tropical Agriculturist Article "Cotton," pages 36 to 38, which details some interesting facts regarding the gift of Sea Island Cotton to the American planters.

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QUANTITY PER ACRE.

The American Cotton was estimated by the Hon. Levi Woodbury at 250 to 300 lbs. per acre in 1835; since then, its cultivation having extended to Alabama and southward, the returns of those States are 400 lbs. per acre and upwards, in consequence of their finer climate and longer summer; in all probability, that of Texas averages still more.

The Cotton Plant, which in Carolina is an annual, being killed yearly by the frost, rising only to a spread and height of eighteen inches becomes a perennial, of from five to six feet in height and spread in warmer climates. If we may rely on an experiment made on ten acres in Jamaica, the American Sea Island seed gave a return of 500 lbs. of wool per acre, (corresponding with that in Demerara); and was expected to yield at two crops per annum 1,000 lbs. per acre,* the wet season however is less favourable to the opening of the pods, the regularity of the picking and the dry quality of the Cotton; but the same description of Cotton in Carolina gives only 150 to 180 lbs. per acre.

The expectation from crops in India is only 300 lbs. per acre, or at most 300 to 500 lbs. of Wool from American seed. The native seed is said to yield far less; and that exported is of an inferior sort. The East India seed which I have seen is small, and would easily pass through between the rollers, and having a close adhesive tuft is the more difficult to clean unless by the saw gin. Both causes may possibly be owing to a want of change of seed, or a rotation of crops; the neglect of which is ascribed as causing the abandonment of its cultivation in the West Indies, when it began to spread in America.

AMERICAN AND ENGLISH FABRICS.

The American White and Gray Cottons are now maintaining a successful rivalry with British manufactures in foreign markets. Their unbleached domestics, as also their white calicoes, command a higher price, from their superior strength and durability, than

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* Statement by H. Gourgues to the Assembly of Jamaica.

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English goods.* While the American manufacturer saves the difference of freight, he buys a superior article, and gives ½ a cent. to 1 cent. more per lb. (¼d. and ½d.) than for shipping qualities sent to England.

The English manufactures for foreign markets are composed greatly of East India Cotton, which is shorter and weaker, though possibly finer, than American; it is also greatly mixed with particles of brown leaves and motes, which, notwithstanding all preparatory processes, get spun into the thread and weaken its adhesion; and though they are removed in the dressing of white cloths, they yet leave the web less entwined throughout: the leaves and motes are occasioned by neglect of picking the Seed-Cotton from the pods as they successively open.

The fibre of Cotton,† viewed through a microscope, is described as having a range of hooks on its edges, by which one fibre adheres to another. On this account it is said to be less fit for surgical purposes than flax; the fibre of which is found to be a succession of smooth hollow joints. Where these serrated edges are less perfect the thread will be weakened, and to prevent their breaking, the English Fabrics require a slower operation, especially when mixed with East India Cotton.

It is said by an English operative, who counted the strokes with his watch in his hand, that the American spinner, having paid from 5 to 10 per cent. higher for his selected wool, gains 20 per cent. by the rapidity of his machinery; as, when weaving for a foreign market, he can give 130 strokes at the loom per minute, instead of 100 to 110. On this point, however, I only repeat the information received. The American manufacturer has likewise, in different portions of the States, a great command of water-power, and in selecting new situations, in such an unoccupied country,

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* In the year 1831 the export of American manufactures was £220,000 sterling. —*American Almanac for* 1833, *page* 126. In 1841, it was £600,000 sterling, chiefly of white cottons.—*Ditto for* 1843, *page* 191. In 1847, the value exported was £816,500; and in 1848, it reached £1,143,600 sterling.—*Ditto for* 1850, *page* 176.

† Baines' History of the Cotton Manufactures of Britain.

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they allow no grog shops in their neighbourhood, they having found that the expense of maintaining the paupers thereby created, costs them more than each State gains by the sale of licenses to publicans; thus they save the strength, time, and continuous labour of their workmen. Generally in their other manufactories, the workmen breakfast at seven in the morning, before commencing work, and are reckoned to save from fifteen to twenty minutes, which otherwise would be lost in recommencing and collecting their tools, &c &c.

EAST INDIA COTTON.

Having mentioned the broken leaves mixed among the Indian Cotton, let us now refer to the cause. The pod of Cotton consists of three divisions, which on becoming ripe, open and separate from each other under the influence of a hot sun, allowing their contents to drop either more or less out, and to become exposed to wind and weather. Three fine leaves surround the pod, which soon become brown and dry, and get mixed with the Cotton when left neglected on the tree; so as to render it very difficult to remove the Cotton seed without breaking these dry and get mixed with the Cotton when left neglected on the tree; so as to render it very difficult to remove the Cotton Seed without breaking these dry leaves, and intermixing them with the wool. But, if the Seed Cotton is removed as the pods successively open, these three leaves are then tough and yellow, and allow it to be picked out entire and unbroken. The smaller fingers of women and children are found more nimble and better adapted than the larger fingers of men, for picking out these three clusters of Seed Cotton without breaking the leaves. The common East India Cotton seems to be left long exposed, and comes home mixed with leaves, twigs and sand: the refuse, when the whole is put through the saw gin, being one-fourth of the quantity brought from the field; whereas at Manchester, the waste on American does not exceed 10 per cent. This neglect is ascribed to the number of Hindoo holidays, the control of country bankers over the growers, and the apprehension of a higher annual land-tax being exacted by the East India Company should they produce a better article.

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It is replied that the Hindoos would work, notwithstanding holidays, were they liberally encouraged by resident Englishmen up the country, instead of being under native agents, who most probably sell the best Cotton to weavers on the spot, and only forward the less saleable to the coast. As the Company cannot now engage in commercial speculations, the tenure of their charter induces every encouragement to speedy local improvements. It appears that the ultimate buyers, residing entirely on the coast, have nothing to do with its production or transport, and purchase it only as an article of speculation or remittance; so that the exporter has no direct interest in its original improvement. In quality the Indian wool compares most nearly with the finest American, and could its staple be a little improved, would rival it in the British market. "It is likewise distinguished," observes Dr. Royle, "from the American short-stapled cottons for some good qualities. The first of these is colour, by which yarn and cloth in which it is employed are much improved in appearance. The second is the swelling of its thread, which, when the cloth is bleached enables the intermediate vacancies to be filled up, giving the whole a more substantial appearance. The third good quality is that in dyeing it takes the colour more uniformly than other Cottons. The best quality of the Bombay Cottons are those from Broach and Surat, which in good seasons, are found to be equal to middling-bowed Georgia. With respect to long-stapled Cottons, the presumption is that they can be grown in India of an equally fine texture with those of America."

The improved East India Cotton will probably, for some time to come, be bought up and manufactured on the spot, as but little of it has yet reached England, and must on its arrival compete with American. A large proportion of it is likely to find a better market in China. The averages of five years up to 1841-2 give only 66,000,000 lbs.* as exported to Britain, and 90,000,000 lbs. to China. The largest quantity obtained from India is but one-sixth of our consumption, and of this above one-third appears to be re-exported from London.

* Anti-Slavery Reporter for October 1845, page 182.

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AFRICAN COTTON.

Considering therefore the general quality and limited supply yet received from India by free labour, the whole sea coast of Africa presents a large, cheap, and more contiguous field for the wants of England; while it offers an extensive market for our manufactured goods. Park and almost all African discoverers speak of markets for the sale of native cloths, made of their indigenous Cotton; but the separation of the raw material from the seed must occasion them much trouble and loss of time. So far as I can learn, the process is very rude, and by hand picking is very tedious. The saw gin moved by the hand will become the means of supplying their own wants first, and thereafter of increasing exportation; the screw-press packing it into square bales for shipment. The original mode of packing, still practised, was for a man to stand inside of a large round bag and press it down with his feet. St. Domingo Cotton is still liable to this objection, and is thereby exposed to a double or triple freight.

The question is does Cotton abound on the coast of Africa? From the reports of Missionaries and of gentlemen who visited the Niger it appears to be plentiful; and they are the men who by acquiring the esteem of the Natives, rendering them teachable (as in many instances they have), and residing among them, are the most likely to introduce both the saw gin and screw-press. Of cotton cultivation the natives most likely know more than Europeans.

I understand, from the Secretaries of the Wesleyan and Baptist Missionary Societies, that the missionaries of those societies have not only their sanction, but their instructions, to promote such objects among the Natives at their several stations, as a means of enabling the Natives to support their missons, and of drawing the aborigines within reach of teachers. We find these Missionary establishments all along the coast of Western tropical Africa;—and to the former has now been added the Scotch; or rather Jamaica establishment, at Old Calabar, near to Fernando Po.

The cost of a common eighteen saw gin, moved by a wheel and pinion and crank-handle, is about £25 to £30. Larger and more

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powerful would follow, and could be driven by oxen by means of simple gear; a forty saw gin with a screw-press is used in Virginia to clean the crops of the neighbouring farmers at a per-centage on the quantity ginned.

The advantage gained in Tropical Africa consists in the much larger return, from the same extent of surface, than the colder climate of the States can average. I have generally found a tree yield upwards of eight ounces of wool at one bearing, on a space of five feet square; which, at two crops per annum, would thus produce 800 lbs. per acre, or double that obtained from the Southern States by slave labour.

In regard to experienced labourers for Africa, it is a gratifying fact that many of the planters in Maryland and Virginia would emancipate their slaves, provided they could be sent out of the country so as to save them the expense of supporting them, which the laws of these States make imperative on setting them free. In proof of this disposition, the Government of St. Domingo was at the charge, about twenty years ago, of conveying 13,000 Negroes from the Slave States to that Island, where they were located as free men. It is, in all probability, through them that the saw gin has been introduced for Cotton; the screw-press being still required on the coast, previous to its shipment.

Natal, near the Cape of Good Hope, is now obtaining the attention of English colonists, as an extensive field and favorable climate for Cotton. Having furnished some Honduras seeds to a gentleman connected with the Cape, a communication which accompanied them was printed in the Graham Town Journal, of 10th July 1845; embracing, more in practical detail, several of these and other points relative to its cultivation. I am informed that some bales of Cotton have already been sent from Natal, and tropical Africa should not be less productive. Among the samples produced is a little brought from the Niger, of a strong useful quality; also two spindles of native made thread, and a piece of cloth from Dahomi in Ashanti, woven in narrow strips of about three inches broad and sewed together. It is dyed in different

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shades, with African indigo; for which dye I am told each village has its dye-pit; all indicating the extent of Cotton cultivation in Africa. But we must enable them to present the raw material in a merchantable condition, by the preparatory process of ginning and baleing, that they may be able to give us value in return for Manchester and Glasgow manufactures. Among the communications to the *Times** is one on the Culture of Cotton, signed "An African traveller," which states—"That in the reign of Queen Elizabeth, Europe derived all her supplies of Cotton from the "west coast of Africa. Unfortunately, the slave trade offered "greater commercial advantages, and the produce of that continent "became neglected. Should it be so, when in one generation, by "the evidence of the American Cotton trade itself, England could "raise in Africa a source of supply, the quality of which should far "surpass even the boasted fineness of the South Sea Island Cot-"ton? From my knowledge of the continent of Africa, I can prove "that her spices, her indigo, her cotton, her coffee, her saltpetre, "her copper, her ivory, her quicksilver, and her gold could be put "into European markets at one-third the price of the similar pro-"ducts either of India or America. The ancient Phœnicians were "not the carriers, as has been long supposed, but the actual pro-"ducers of the riches and luxuries with which they supplied the "inhabitants of Europe; and it is their empire which the French "are attempting to establish again in Africa."

SAMPLES PRODUCED.

Among the samples exhibited to the meeting of the Society were the following—From Honduras, the clustered or kidney seed, showing its form and staple, which was sold at 6*d.* and valued on trial in 1841 at 6¼*d.*; also its native Cotton, resembling Sea-Island, which when saw-ginned, was valued at 6¾*d.*: the seed of it is almost entirely free from down, and therefore capable of passing easily the roller gin, and bringing a much higher price.

A specimen of the Anguilla, grown in British Honduras, is one of the very finest Cottons known. Its seed is entirely free from

* *Times*, 10th November, 1845.

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down, easily separated, and therefore readily cleaned by the roller; its seed was the smallest among the samples. There are other kinds (indigenous to Honduras), which are fine, but covered with down; rendering them difficult to clean except by the saw process; one kind is of a grey colour; another is red, furnishing the cream coloured Cotton.

From other quarters there were produced a sample of Sea Island, as grown in Jamaica from American seed; it was saw ginned. Also a small sample of the same hand-picked, for the sake of comparing the fibres of each. Its seed is, like that of its parent, the Anguilla, quite bare, and therefore easily ginned by either process. It is the Sea Island, from American seed, that is now grown in Egypt, and generally quoted at 7*d.* to 9*d.* for saw ginned sorts. Some of the common leafy Cotton of India, as it came to England contrasted with a specimen of improved Madras sort. In order to show how the leaves get intermixed with the Seed Cotton, there were shown two pods, as taken from the tree, when neglected and exposed to the weather. These pods were from Jamaica; the wool fine, and the seed as bare as Sea Island or Anguilla; thus proving that we have various fine qualities capable of being rendered remunerative, in our own West Indian possessions, and having all the advantages of larger tropical perennial crops than can generally be got in the more temperate latitudes of the American States. How far it will be profitable to grow these, will depend chiefly on the greater productiveness per acre, in or near the Tropics, and the saving of time and hands on perennial compared with annual crops, especially under a more improved system than was formerly practised. There is some valuable practical information in the forty-seventh volume of the Transactions of this Society from a Planter in Demarara;—page 178.

As compared with other tropical products, it must be remembered that coffee takes from three to five years before any returns can be expected; and that the introduction of sugar making into Africa, would require an expensive apparatus at the outset, which Cotton does not, while it returns a crop in about nine months after planting.

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CAPABILITIES OF HONDURAS AND YUCATAN.

In regard to the British settlement of Honduras, as a future field for cultivation, it presents an extent of sea-board of above 200 miles, by from 50 to 100 miles inland, and is nearly three times the size of Jamaica, the largest of our West India Islands, from which it lies about 700 miles due west on the mainland; it possesses a virgin soil, fine climate, several navigable rivers, and numerous means of water carriage. Would government guarantee security in its land, for the purposes of cultivation, it could afford scope for the employment of large capital; but at present it is restricted to the mere products of the forest, almost entirely to mahogany and logwood: as it is, its imports now reach above £400,000 sterling per annum, employing 22,000 to 28,000 tons of shipping.

Dr. Thompson has brought home one sort of the native Seed Cotton of Yucatan, which is among those produced; it is fine, but from its downy nature could only be cleaned by the saw gin. So extensively was this article grown in Yucatan that, in the times of the old Spanish Historians of the Conquest, the Natives came to fight against the Spaniards in defensive armour thickly padded with cotton. The Indians of that Peninsula, as described by Stevens, are familiar with the culture of cotton, of sugar along the coast of Campeachy, and of tobacco and maize in the interior. They cannot know the use of the saw gin; but an American gentleman is mentioned by Stevens* as now growing and manufacturing Cotton in the neighbourhood of Merida, for disposal in that city and vicinity.

When Dr. Thompson was in Yucatan he saw mule loads of Cotton in the seed (that is, as it came from the tree), conveyed to Valladolid and Merida, to be sold there; thus carrying 75 per cent. of unnecessary weight, by not freeing it from the seed on the farm where it was grown.

The Indians, though nominally free, are much oppressed by the Spanish descendants, and from their youth up to advanced age in a state of debt for small advances. Were political disabilities re-

* Stevens' Second Incidents of Travels in Yucatan.

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moved, many of these Indian Yucatecas might be induced to settle within the limits of British Honduras, with their whole families, and cultivate cotton, rice, tobacco, and sugar with which they are already acquainted ; but on which the length of this paper forbids me to enlarge at present.

The great increase of slave-grown Cotton in the States, and our dependance on it; the greater strength of their common fabrics, and their competition in foreign markets with those of Britain; the yet limited supply obtained from India, the demand for it in China, the inferiority of that generally sent, and some of the causes of that inferiority; the advantage gained by the use of the saw gin; the practicability of introducing it and the screw-press along the coast of Africa, as a new means of obtaining more tropical Cotton; the capabilities of Honduras and its samples; and the various qualities of different seeds, have been thus cursorily glanced at, in hope that these topics may receive more attention than it is possible to give them on the present occasion.

Since the above was written the Yucatan Indians have been more generally aroused to assert their independance; already about 4,000 have betaken themselves to the British Settlement for protection, and are engaged in growing Rice and Maize for our Shipping and Settlers. (See Honduras *Watchman* of 15th and 22nd Februry, 1851). Were the improvement of their native soil sanctioned by Her Majesty's Government, an emigration of free aboriginal labourers would soon resume the production of the Cotton and Chocolate with which they were so familiar when Cortez landed on their shores.

Grammars with Vocabularies of the Maya and Mosquito languages now afford means of communication with these tribes; the Carib has had a like service rendered to it in the Settlement, and now only waits the means of publication.

Note to page 124—Directions for Planting Cotton, and preparing it for Shipment; taken from the Graham Town Journal—For many other useful details the reader is referred to the Tropical Agriculturist by G. R. PORTER.

COTTON SEED requires a dry soil, and sandy rather than clay; it will thrive in a poor soil, but better in good earth. The ground must be of that free

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open nature to allow the tap-root to penetrate without obstruction. It is better to try experiments on a small scale, as experience can be obtained at a cheap rate in the first instance which may otherwise prove very costly—such as relates to the soil for different kinds; the quantity from each tree, or from an average number or proportion per acre; the proportion of cotton to the seed; which is finest, longest, or strongest; which is most easily cleaned, or most downy and difficult, or most subject to attacks of insects; or grows best near the sea or inland.

It is an object to destroy the insects, catterpillars, &c. as soon as they appear, to prevent them depositing their eggs: for this purpose fowls and particularly turkeys are serviceable; and perhaps indigenous cotton is less subject to insects than newer kinds. A great deal depends on keeping the seed in a dry and well aired situation, and turning it over occasionally till required, removing any appearance of them, and burning refuse leaves &c. as soon as possible.

SEA ISLAND COTTON, which is an annual in the United States of only 18 inches apart, becomes a perennial in the tropics of six feet, and needs to be planted six to eight feet apart, bearing well for five or six years; and in proportion according to the temperature of the climate; giving a crop in 6 to 9 months according to the time of planting. It should be planted near the sea, and rather on a saline soil. It must be cleaned by the Roller Gin to obtain the best price—at present 1s. to 1s. 6d.—formerly 1s. 6d. to 2s. The Egyptian is said to be from Sea Island, and brings the best prices of the saw-ginned cotton, about 7d.

ANGUILLA is a very fine cotton, and the original of the Sea Island from the Bahamas; it is said to be fit for making the finest lace when carefully picked and roller-ginned, valued about 1839 at 2s. to 3s. per lb. It yields only 17½ per cent. of cotton; other kinds 23 to 25 per cent.

KIDNEY OR CLUSTERED SEED.—That of Honduras is very hardy, and grows everywhere, near the sea or far inland, yielding about 8 ounces per tree, of wool per crop, at 6 feet apart. Some kinds bear two crops. It can be picked from the tree with ease, with ordinary care, without breaking a leaf, and is easily cleaned by the saw-gin. Its value is equal to the best New Orleans, and the same machinery serves for spinning it.—In 1842 I sold it at 6d. per lb. in Liverpool and Glasgow.

DOWNY COTTONS.—When the seed is much covered with down or short hair they can only be cleaned by the Saw Gin, however fine: so that the fine sorts have their texture injured for the high priced class, and are therefore reduced to the ordinary sort. The American upland is very downy but strong, and therefore can only be cleaned by the Saw Gin. Some kinds have so little down that they can be cleaned by the Roller Gin. If the down is of red colour it makes the cotton cream coloured.

INDIGENOUS COTTON deserves attention as most likely to stand the climate, and to be less the prey of worms and flies. They improve by cultivation, and when neglected become small, covered with hair or down. They however indicate the soil on which cotton will thrive if abundant.

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QUANTITY OF COTTON PER ACRE seems to vary according to climate and soil,—the Sea Island at Edesto River and St. Simonds Island, U. S., yielding 100 to 150 lbs. per acre on " Pine Barrens," or land previously unproductive. South Carolina yields 600 to 800 lbs. of seed cotton per acre of land, 150 to 200 lbs. of wool.—250 to 300 lbs. is reckoned by Levi Woodbury the average of United States' crops. The South is supposed to give 400 lbs. and upwards in Louisana, Alabama, &c. A planter in Jamaica asserted to the writer that he had 1000 lbs. per annum from Sea Island at two crops? Whatever quantity it would yield may depend on a long dry season, and hands enough to pick it as it opens. A warm climate where no frost, or little prevails, will have the advantage in saving labour, and in abundant crops. It is an object to try whether, with these advantages Free labour cannot compete with Slave labour, which with its prime cost, deaths, clothing, food, &c. costs the Americans £30 or £40 per annum.

ESSENTIAL POINTS REGARDING COTTON.—Prevent the increase of insects, particularly the cotton bug, by destroying them before their eggs are deposited, by use of lime in powder, sprinkled through a cullender on the leaves &c. —keeping them free of weeds;—turkeys and fowls are of great service.

PICKING THE TREES should be done as soon as the pods open, before the seed cotton separates from its receptacles, it is then in its most clean state and easily collected. What is *stained* should be at once (in the act of picking) put by itself, the picker having two bags, one for clean, another for stained;—or a different set of pickers following for the stained alone.

DRY POD LEAVES.—Three fine leaves surround the pod which become brown and very brittle (as the cotton is left longer on the tree); when neglected it is very difficult to pick the seed-cotton from the pod without breaking these leaves, and mixing it with the wool, but if picked as the pod opens, these three leaves are then yellow and very tough, and therefore unbroken,—so as to be got separate from the new entire seed-cotton.

WOMEN AND CHILDREN are the best seed pickers,—their small fingers getting hold of the tip of the three clusters which form the pod and pulling them out entire without touching these three leaves, and having more nimble and pliant joints save time and wages. If these dry leaves once get mixed, the Saw Gin breaks them up to atoms, and they are spun into the threads, thus forming specks which weaken and disfigure the gray cottons made from East India Wool.

POPULATION.—In order to secure plenty of hands for picking, it is desirable to have cotton plantations near towns, or where plenty of young hands can be obtained to collect the ripe cotton as it opens, ere it blows about in the weather.

GINNING.—The use of the Saw Gin by *rapid* and *powerful* means is necessary to compete with America for ordinary qualities; a common hand Saw Gin may do at the outset, but to any extent, Cattle, Water, or Steam, are necessary to get the crop to market, and save expense of wages. The common 18 Saw Gin will give about 50 to 70 lbs. of cotton wool (from 200 to 300 lbs. of seed-cotton): —the same Gin by steam will turn out 300 lbs. of wool.

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SCREW PRESS can be driven by Cattle, as the cotton accumulates from the Gin, both being under one roof. The screwing of the cotton into compact bales saves heavy freight: say ½ or ⅝ (of a penny) per lb. instead of 1d. or 1½d. It is described in the "Tropical Agriculturist."

CLASSING AND SEPARATION.—Besides clean and stained cotton, it will be found on observati n that the worst and heaviest falls immediately at the back of the Gin, containing sand, earth, and dust, while the lighter and better is thrown to some distance back:—the two should not be mixed, but packed and marked separately,—which the Ginner and packer if only hired is apt to collect all in one. When sold in Liverpool the manufacterers often obtain a deduction of 2 per cent. and upwards for sand and refuse.

FANNER AND BRUSHES.—In the Saw-Gin the brushes sweep the wool off the saws, and the arms of the fanners blow it out of the frame, to a greater or less distance. The brushes being of hair get worn out, and when this is the case the cotton is apt to be carried round a second or third time, and passing through the bars of the iron frame it gets entangled. It is therefore of importance to examine the brushes frequently, and to replace new hair. Spanish broom answers very well in place of hair. See that it touches and sweeps the teeth of the saws fully,—keep the teeth clean and free from rust and damp.

Prevent if possible the cutting of the seeds on the saws, as the oil stains the cotton. For this purpose see that the mass of seed-cotton is always presenting a fresh surface to the saws by moving round, which it will do while there is cotton on it, and full enough to pass against the saws and front of the box gently without cramming.—Saw and Roller Gins may be had at FAWCET AND Co.'s, Iron Foundry, Liverpool.

COTTON OIL.—Oil is got from the cotton-seed of America, and sent to New York for sale, whenever the seed is not so fresh for sowing. Cattle and goats are fond of the seed even three years after cleaning—but it should be singed if any wool remains upon it. To obtain the oil the seed must be first bruised, and then either pressed, or boiled with hotwater, skimmed off and evaporated. If pressed preserve the oil-cake for feeding cattle in England—where Linseed oil-cake is worth from £5 to £6 per ton.

SCIENTIFIC INTELLIGENCE.

Fall of Meteoric Stones.

On Saturday the 28th of February last, two large Meteoric Stones having fallen with considerable velocity so as to bury themselves into the earth near the village of Parnallee in the district of Madura, the Rev. Mr. H. S. Taylor, Principal of the American Mission

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there, having been made acquainted with the fact, proceeded himself to examine the spot, and at the request of the villagers reported the circumstance of their fall to the Collector. The following are Extracts from his letters upon the subject:—

"Near the Village of Parnallee in this Talook two Meteoric Stones have fallen. I have been on to the ground and seen the places where they fell, and the exact impression made in the earth where they lay. As no rain has fallen since, I was able to see that there was no mistake about it. The noise made as they came through the air, made a deep impression on the minds of the people in that region, and was heard, I find from reports, along the sea shore up to Teruchooly. They fell about three miles apart from each other. The smaller one weighs about 37 pounds, and sunk in the earth when it fell two feet and eight inches. The larger one is from three to four times as large, and sunk in the earth two feet and four inches. It struck the earth flatwise. The smaller one fell about perpendicularly. The larger fell (coming from the North a little to the West) making an angle with a perpendicular line, of about fifteen degrees. Persons were standing near each place when they fell. Many worshipped them. The villagers gave them up to me on condition that I should inform you, and save them from trouble made (or rather which they feared some officials might make). I do not make this statement officially, but I am ready, if you desire it, to make an official statement on the subject. In writing this I have fulfilled my promise to the people there.

* * * * * In respect to Mr. Murray's request through you, I would state that I gave a somewhat minute account of their fall, &c. to Dr. Colebrooke with liberty to publish should he think best in the *Athenæum.** If he has done so, this may not be needed. I will however give a few particulars.

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* TO THE EDITOR OF THE ATHENÆUM.

SIR,—Some of your readers may be interested to learn that two Meteoric stones fell in the village of Parnallee in this district, and not far from Ramnad on the 28th of February and at noon. The fall was preceded by a noise which it is stated, bore an analogy to the reverberation of thunder, though it was much louder, and the stones were propelled with such force that though one of them weighed 37 pounds, and the other was four times larger, they were neither of them seen in their transit through the air, though numbers of persons were standing by at the time. They fell about 3 miles apart and both became deeply imbedded in the ground, sending up a cloud of dust when they struck. They were forwarded to Madura and are now in the Collector's Cutcherry. They bear evident appearances of having been subjected to the action of fire and are covered with a black smoke-like coating. Their formation appears to be partly granitic, with a good deal of ferruginous matter interspersed. The natives of course accounted for their presence by attributing them to the wrath of a *swamy* whom they sought to appease by worshipping them. Others held an equally extravagant hypothesis and supposed them to have been blown from a cannon at

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They fell on the 28th of February, Saturday, at about noon, a little South East of the Village of Parnallee, Latitude north, according to the Government Map, 9° 14', Longitude 78° 21' East.

The largest one fell a few seconds before the smaller one, and from two to three miles North of it. As was manifest from the hole it made in the ground when it fell it came from a direction some ten degrees West of North, making an angle of about 15 or 20 degrees with a line perpendicular to the earth's surface. It struck the earth, (or at least lay in the bottom of the hole made by it) flatwise, on the side that is most convex. The most round or convex side of the smaller stone also was downward, this being the position they would naturally assume as they passed with great velocity, through the resisting atmosphere, an idea which did not occur to me till now. I had before simply noted the fact. The larger stone sank into the earth when it fell two feet and five inches in a perpendicular direction. The smaller one about two feet and eight inches. The smaller one fell also about perpendicularly. The smaller does not appear in any respect like a fragment of the larger one. The specific gravity of the smaller one when it fell was about 3·3, water being the standard of unity. I observed that the specific gravity was increased after exposure to a shower, or rather that of the smaller one was. I did not try that of the larger. The crack on the convex side of the larger one I did not perceive at all till it had been wet, and then at first it was but just perceptible. Afterwards it gradually opened, I suppose owing to the oxidation of the native iron it contains, perhaps however to other causes. The stone had not been wet till they came into my hands, April 21st. They each of them fell in cultivated fields, one of which had been harvested. The straw in the other was still standing.

The *noise* seems to have been terrific to the Natives, causing those near to crouch from fear. It came like two claps of thunder, as they fell one after the other, and continuing for some time, but gradually growing less loud. As they fell through the whole depth of our atmosphere this would naturally be the case. The noise appears to have been heard at Tuticorin forty miles distant. At this place, sixteen miles North, it excited considerable interest among those abroad at the time. The noise must have been great, occasioned by their great velocity. Taking their specific gravity into the account, say 3·3, their size being about that of large cannon balls, some allowance also being made for their irregular

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Tuticorin. The report of the descent of these bodies was heard distinctly at Tuticorin 40 miles off, and in all the surrounding villages.

The subject appears to me an interesting one for scientific enquiries, and this is my chief reason for requesting you to have the goodness to cause its insertion in the columns of your paper.

I am, Sir,
Your obedient servant,
J. COLEBROOKE,
Zillah Surgeon, Madura.

MADURA, 9*th April* 1857.—*Athenæum.*

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shape, from the depth they penetrated the soil, which was of about common hardness, those who have observed the power of projectiles in such cases, will be able to calculate, approximately, what that velocity was.

Of the excitement among the Natives I suppose I need not speak. I visited the place because of the rumours that were flying abroad, making it evident to my mind that some thing peculiar had there transpired. First I saw the holes from which, in the cultivated fields they had been freshly taken, no rain having subsequently fallen, and saw at the bottom the *hardly compressed*, and exact impression left by them as they were taken up, and then as soon as I saw the stones, I knew instantly they were the identical ones which had been taken up from those places. As I was more or less known in that region, and there is no gentleman whatever any where near, the rural people, utterly ignorant of the cause, came in great numbers to state the facts and ask some explanation. Some of them supposed they were gods that had fallen; some that they had been shot from cannon on ships at Tuticorin, and some that a Brahmin had brought them from the sea by his Munterums. Some rejected all these theories, but no one could tell or feel satisfied as to how these things could be. By simply striking my staff through the air I could explain to them the noise; and by tying a stone to a string and swinging it, I could make them understand the centrifugal and centripetal forces, and how that from some disturbance in these forces, stones moving about some centre, like the Moon about the Earth, might fall. The explanations gave them relief. They put confidence in me, and gave me the stones at my request, that I might save them from the trouble of any official investigation, and put them into some Museum or Scientific Institution.

P. S.—I forgot to say that there was nothing peculiar in the state of the atmosphere. It was a clear day. When the stone is sent on to Madras, if any scientific Gentleman makes an analysis of it, for the Museum, please be so good as to ask a copy of it for me.

Report upon Captain Taylor's proposed Jetty thrown over the Surf at Madras.

The undersigned* having met agreeably to Extract Minutes of Consultation, July 24th, 1856, have examined the Model of Captain Taylor's proposed Jetty to be thrown over the surf at Madras, and considered the subject as treated of in his Memorandum. The Jetty would consist of a line of piles, or rather masts, planted in the sandy bottom, but mainly dependent for their support upon shrouds or stays secured to anchors on either side of the line. It

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CHRIS. BIDEN, *Master Attendant.*
R. KENNEDY, *Assist. Civil Engineer.*

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would be a Pile Jetty, peculiar only from the lateral strength being obtained by means of rigging, instead of the usual deep hold on the ground and support from the connection of parallel lines of piles, which ensures the stability of such works in general. The great span from mast to mast can hardly be said to be a peculiarity of structure, as it is not essential, and as Captain Taylor says "it might be necessary to support the centre of the great divisions by one pile screwed or driven."

After carefully reading Captain Taylor's paper, the Committee feel confident that it was written under a wrong impression as to the difficulties to be contended with in piling across the surf; and in the erroneous belief that several unsuccessful attempts have been made to construct a pier.

Mr. Piron's suggested Pier, the only one that ever approached maturity would have rested on iron piles; and no executive difficulties were anticipated in its construction by those acquainted with such undertakings. That this project was not carried on to completion was not the result of failure in execution, but simply the consequence of the work never having been attempted.

Such a Pier as Captain Taylor proposes, would be an ingenious mode of constructing a temporary Jetty to meet a sudden occasion, where spars of sufficient length, and the other requisite material were procurable. But as a permanent means of crossing the surf would have great disadvantages, liable to injury, not only from the settling of the masts, but from the anchors losing their hold by the sudden shifts of sand that are of frequent occurrence in the bed of the surf. It would in the opinion of the Committee be a constant source of anxiety and expense till the masts had worked down to the maximum depth required, when they would take the place and act but indifferently the part of driven piles, which might have been inserted far more accurately as to position without the aid of means so complicated and costly, as the rigging and anchors suggested by Captain Taylor.

With a strength and capacity quite incommensurate with the trade of Madras, such a work when completed would do hardly

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more than establish the fact that a Pile Pier would suit the locality, and in the view of the Committee no such mere experiment is necessary. If no other work of the kind had ever been attempted, the Court Town Pier on hollow iron piles carried through a heavy surf on the coast of Ireland by the most simple means, would have shown the perfect practicability of spanning the breakers of the Madras beach by the aid of Mr. Mitchell's screws. But there are many such Piers in existence now, piles have been planted securely in water 50 feet deep, and cases are recorded of their having been screwed into the sandy bottom of the sea to a depth of five and forty feet. The successful results of such trials prove more than is required, and the Committee feel confident that if the object were only, as Captain Taylor says, to carry water to ships' boats outside the surf, a double, or perhaps a single line of iron piles would effect the purpose more securely and more cheaply than the Jetty proposed.

While thus giving their opinion against Captain Taylor's proposal, the Committee must be allowed to notice the great value of such suggestions; though the plan proposed may not be considered suitable on investigation, any reasonable project may be suggestive of the work required; or at all events give life to the subject; and in this case, if it had not chanced that a proposal from England had brought the matter before Government again, this project of Captain Taylor's would have done so most opportunely, and the Community of Madras is not the less indebted to him for the effort to supply this essential desideratum in the Port.

Report of the Committee appointed to examine Messrs. SAUNDERS *and* MITCHELL'S *project for erecting an Iron Pile Pier at Madras.*

The undersigned Members of a Committee,* appointed to report upon a Pier projected for the port of Madras, having examin-

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CHRIS. BIDEN, *Master Attendant.*
R. KENNEDY, *Assist. Civil Engineer.*
J. GOOLDEN,
WM. BURTON WRIGHT, *Locomotive Supt. Railway.*

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ed Messrs. Saunders and Mitchell's plan and specifications; and perused with care the recorded opinions of several who have on previous occasions been engaged in similar enquiries, are now prepared to speak with confidence upon the subject submitted for their consideration.

The Extract from the Minutes of Consultation referring Messrs. Saunders and Mitchell's proposal for Report, does not specify any particular points as requiring the special attention of the Committee, from which they infer that a general opinion as to the advisability of accepting their proposal is all that is expected from them. But having divided their enquiry under the following heads, they think it better to offer their opinion upon each important point investigated, viz.

1st. The practicability of constructing a Pier on Piles across the Madras Surf.

2nd. The fitness of such a Pier for the Port of Madras, with reference to its effect upon the Coast line, and the effect of the sea upon it.

3rd. The suitableness of the proposed Pier in form and dimensions; and in description and strength of material.

4th. The Estimated cost of the work, whether moderate or otherwise?

5th. The value of the suggested Pier whether such as to warrant the outlay required for its construction?

On the first point, viz., the practicability of constructing the proposed Pier, the Committee have no hesitation in offering a favorable opinion. They have every reason for believing that no soil will be met with through which a Screw pile cannot be driven by the apparatus used by the Contractors; and in the Court Town Pier they have proof sufficient that the operation of screwing can be carried on without the surf interfering with the work, while the remarkable experiment quoted by Mr. Lennon in the year 1803, in which a single pile of wood (offering a far broader surface to the wave in comparison with its strength than the wrought Iron piles suggested in this case,) withstood the action of the surf for 6 monsoons,

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satisfies them, that each solid Iron pile standing unsupported except by its hold on the bed of the sea, is capable of resisting a greater force than the blow of the Madras surf. Assured upon these points, and having the support of all who adopted Mr. Piron's proposed Pier, which resembled the work now under review in all essential particulars, and above all with the ample evidence before them of Messrs. Saunders and Mitchell's successes in works of a like nature in other ports of the world, the Committee do not hesitate to declare the work not only perfectly feasible, but simple of construction, and such as may be rapidly completed.

Nor are the Committee less confident and unanimous in their opinion upon the second point; viz., that an Iron pile Pier such as is now proposed, is the most suitable means for spanning the Madras surf. First, because it will cause less interference with the ocean-current than any other description of Jetty equally strong and effective, and consequently will risk in a less degree any injurious change in the Coast line; and secondly, because with great strength it will offer no unnecessary resistance to the wave, and thus have one of the chief causes of injury reduced to the utmost.

With regard to the plan of the proposed Pier which is that of the letter **T**, the head being parallel to the Coast, the Committee observe that this form is rendered necessary by the circumstance of the direction of the ocean-current being parallel to the shore and its velocity so great at times, that boats could not be moored with safety across its course.

In examining the dimensions of the Pier, three points have been considered.

1st, Whether the length will be sufficient to ensure the Pier-head being beyond the break of the surf.

2dly, Whether its height above water is such that the sea will not break over it and,

3rdly, Whether the area of platform is sufficient to accommodate the trade of Madras.

The length of the Main Pier is to be 960 feet and the breadth

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of the Pier-head being 40 feet, the outer end of the Pier will be 1,000 feet from high-water mark on the beach.

From the best information that is obtainable it appears probable that the surf never breaks at a greater distance from the shore than from 500 to 600 feet, at times when cargo boats could ply; though it may do so in stormy weather when the waves of the bay are so broken that the outer surf cannot be distinguished.

Mr. Taylor, when Astronomer at Madras in 1844, offered the following opinion upon the distance to which the surf extended:

"From a careful measurement in the months of October, November and December 1838, it appeared that on occasions such as it would be considered dangerous to permit a boat to go off from the beach, the surf extended to a distance of 450 to 500 feet from the shore: but that during a smart gale on the 6th December the surf extended to or beyond a buoy which was 828 feet from the shore, but the confusion was such as to render the distinction between breakers (such as occur at sea) and the surf, very difficult." Captain Biden who has given his attention to the same subject, and has had even better opportunities of judging than Mr. Taylor, also gave an opinion upon this point, at the time Mr. Piron's proposed Pier was under consideration. He expressed himself as follows:

"The surf broke at 350 feet from the coping stone on the 14th October 1844, when the last survey was made, and then the weather was moderate." "About 500 feet from the road-bulwark or barrier, and 400 feet from the inner wash of the surf, is a ledge of sand, and just outside this bank the depth increases from 10 to 15 feet, but within and without this ridge of sand, and excepting that sudden change, the soundings are very regular; this bank doubtless causes the break of the outer surf in rough weather." From these statements and the opinions of others who have either like Mr. Taylor or Captain Biden taken the subject into consideration, or who having passed much of their time in sight of the surf have become acquainted with its peculiarities, the Committee do not hesitate to say that if the head of the Pier is placed as Messrs.

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Saunders and Mitchell propose, it will be beyond the break of the surf, at all times when the sea is not too rough for cargo boats to be employed.

The height of the platform above the ordinary high water mark is 15 feet; which is far above the crest of the surf even in stormy weather. That it may be found so on the occurrence of those peculiar cyclones which raise the surface of the sea much above its usual level, the Committee cannot say with perfect confidence; but as this effect upon the ocean on the Coast of Coromandel is by no means the constant result of a hurricane, and as even the more usual character of storm has on an average only visited Madras once in 10 years, they do not consider it necessary to recommend any change in the projector's plan to guard the Pier against a risk so remote.

The sufficiency of the wharfage room on the Pier-head will depend upon the rapidity with which the goods are despatched from it, and this again will be mainly influenced by the facilities afforded for their transit between the Pier and the shore.

The Committee observe that in the "Main Pier" or that part of the work which connects the head with the shore, only 17 feet of the entire breadth which is 40 feet, is covered with platform. The reason for this is not assigned, and they cannot think it a desirable arrangement. They do not consider a breadth of 40 feet between the outer lines of piles necessary for the stability of the work, and would look upon so great a breadth on that account as causing a needless expense. But when they compare the traffic of Madras with the means afforded for cleaning the Pier-head, (bearing in mind at the same time how much circumstances often compel the greater part of a day's work to be crowded into a few hours) they came at once to the conclusion, that the Pier is not too broad, and that the change of plan required is an increase in the breadth of the platform and the number of lines of rail it bears. As now proposed, there would be but two lines of rail which under the best arrangement would not probably be found sufficient in the most active season of the year; and as no arrangement however good, could prevent occasional obstructions occurring, it would be unadvisable to trust to one Railway for landing and one for shipping.

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In this particular therefore the Committee urge a change of plan. They consider it advisable that the whole breadth should be covered, that there should be four lines of rail instead of two, both on the Main Pier and the Pier-head; and that the rest of the space should be fitted for the use of foot passengers. If this change is made they believe that the wharfage may be found sufficient for every purpose.

The materials used in the Pier are wrought iron and Baltic timber with cast iron screws on the foot of the piles. Regarding the iron work generally, the Committee are satisfied on all points excepting as to the length of the piles. They consider the arrangement of the material excellent and the scantling adequate. And with reference to the perishable nature of iron when subjected to the action of salt water, and air impregnated with salt, the Committee have only to remark that this material is now so universally employed, and has been found to answer so well in situations equally trying, that they feel confident the corrosion and consequent consumption of iron when so circumstanced is not such as to render it unsuitable to the purpose. The waste of material is evidently retarded by the oxidized coating, which in the first months covers the surface of the iron, and the subsequent decomposition of the metal is so slow that no considerable annual expenditure on repairs is likely to be found necessary; while the arrangement of the iron work in the Pier is such, as to render the operation of removing injured portions practicable and simple.

As to the length of the piles, some further consideration is in the opinion of the Committee necessary. Their lengths as shown in the plan which accompanies the specification appears to have been determined upon a line of soundings not differing materially from those now taken, and if the bottom of the sea near the coast remained stationary, the depth at which the screws are shown in the drawing would be sufficient. But as the combined action of the surf and current, causes at times a very rapid motion of the sand in shore, and considerable changes take place in consequence in the depth of the sea along the Coast line, it is possible that piles of the length suggested might be undermined. The ocean current

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strikes upon different points of the shore at different times; and were it not for the stone bulwark and the groynes that guard the beach, far greater changes might occur in the soundings on any line chosen for the Pier, than need be feared now that the shore cannot be encroached upon. What the maximum effect of this current may be, the Committee have no means of determining accurately. It is probably greater during storms than has been measured; as on the surf and current subsiding after the gale ceases, the bed rises rapidly; but as the boatmen who navigate the surf speak with confidence as to there never being deep water near the shore, it is evident to the Committee that the addition required to the length of the piles is not such as to add greatly either to the cost of the work or to the difficulty of constructing it.

If an effort is now made to detect what the maximum depth of the surf is, some information may be obtained before the North East monsoon ends; as that is the season in which the greatest variation in the depth is likely to occur. This information might be sent to England in January; and upon it the length of the piles might with safety be calculated; due allowance being made for a somewhat greater change taking place than had been observed. As the Committee consider this undermining action of the current to be the greatest danger to which the Pier will be exposed, they beg to call particular attention to this portion of their report.

The Committee do not offer any objection to the use "of Baltic Timber" under the impression that by that name, is implied Red Menel Pine; but if that description of wood has been chosen solely with a view to economy, they must express a doubt as to the advisability of the selection since they believe that Teak of such small scantling as is required in the Pier will hardly cost more than Pine prepared with Creosote, while the former would be found so much more durable than any description of Fir as to warrant if necessary a very considerable additional outlay on its use.

With regard to the cost of the Pier, Estimates have been prepared by two members of the Committee, who come nearly to the same result; namely, that its actual cost, without any allowance for Superintendence and risk would be £70,000. From this it will appear that the Contractors have a margin of about 30 per cent.

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for Superintendence and profit and the chance of loss, and considering the peculiar nature of the work, this does not appear to the Committee to be unreasonable, though at the same time it is so liberal an allowance that it is hoped the additions proposed by the Committee may be included in the present Estimate, in which case they do not doubt that it will be better economy to accept the Contractor's terms rather than to attempt the erection of the Pier by the Government Engineers; who have no experience in works of the kind.

The Committee find a difficulty in conveying in a figured statement the value that might be assigned to the proposed Pier. But a few words will show the existing impediment to the traffic of the port which it is confidently hoped that this work will remove.

The trade of the port, both in respect of Passengers and Merchandize, is carried on in Masoolah boats, calculated to carry two tons of goods in very fine weather. These boats are drawn up on the beach; nearly but not quite beyond the reach of the surf, where the spray breaks over them to the injury of their contents when they are such as to suffer from the effects of salt water. Laden boats are launched with difficulty from the beach; and both in landing and shipping goods, all must be done by manual labour as cranes cannot in such a position be brought into use.

It is needless to remark that the passage through the surf entails further risk of damage and that the inconvenience sustained by passengers is in a sense greater even than that inflicted upon goods traffic. But these difficulties are at the present day greatly enhanced from various causes which are, first the insufficiency of the boat accommodation for the increasing traffic of the port; second, the difficulty of getting the boatmen to work with regularity and order; and third, the constant pilfering that takes place and which is facilitated by the length and often unavoidable deviousness of the transit between the shore and the shipping. All these obstructions to a regular and orderly traffic would be at once removed on the establishment of a Pier. The injury done at the time of arriving at and departing from the shore would be altogether removed, all extra expense avoided, and a facility of transit

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secured to every description of traffic, which is altogether impracticable under the present system.

To speak now of the amount of traffic as it actually exists. The lists of passengers, Emigrants and Troops landing and embarking in a given time do not exhibit the number of those who land and return to Vessels calling at the port; neither do they show the many masters, Officers, and men, who land, and re-embark on board the shipping on the roads; nor the far greater number still of those who go off to Vessels to transact business or to work, and if these could all be enumerated there would still remain uncounted the very many who have occasion to cross the surf, but are deterred by the expense, discomfort or danger attending it. The probable passenger traffic cannot then be exhibited with any approach to accuracy, and in attempting to show the goods traffic that may be expected from the returns of the present trade, so great an amount is missing in the Custom House returns in consequence of the entire trade carried on between the port of Madras and all other ports under the Madras Government being entirely unnoticed that the Committee fear even these Statements may mislead those who examine them. They are however induced to submit them as the best data obtainable, begging that due allowance may also be made for the increase that may be fairly expected when the difficulties of the surf are removed.

Statement A* shows the exports and imports of Madras in the

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* A.

Statement of traffic of the Port of Madras in the years 1854-55, and 1855-56. Value of Goods

		1854-55. Rupees.	1855-56. Rupees.
Imports.	Merchandize . . .	1,91,24,962	2,31,33,876
	Treasure, ...	64,81,955	1,37,16,696
	Total. .	2,56,06,917	3,68,50,572
Exports.	Merchandize, . . .	2,39,48,083	2,91,70,905
	Treasure, ...	82,06,956	44,18,750
	Total. .	3,21,55,039	3,35,89,655
Re-Exports. .	Merchandize, . .	7,17,474	6,64,355
Grand Total. .	Merchandize, .	4,37,90,519	5,29,69,145
	Treasure, . .	1,46,88,911	1,81,35,446
	Total. . .	5,84,79,430	7,11,04,591

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last 2 years, and the extraordinary increase in the trade, since the year 1843, when the last proposal for a Pier was laid before the public, will be found by examination of Statement B.*

By a Memorandum lately prepared by the Chamber of Commerce, it appears that the average number of boats daily employed throughout the year is 70, which make 4 trips in the day. These boats in fine weather carry two tons of measured goods or one ton and a half of dead weight: but when the surf is high the load is greatly reduced, as sails cannot be advantageously used in these peculiar boats, they are worked entirely by manual labour, and eleven men are required to make good the passage over the surf. The cost of conveying goods by such means is necessarily excessive. The minimum hire of a boat to the usual anchorage of the square rigged vessels a distance of about one mile is one Rupee and a half. To the outer anchorage about 1½ mile is 3 Rupees. The cost of a boat to the anchorage of the country vessels is fifteen Annas and for passenger boats to the shipping, the charge is 3½ Rupees.

To these heavy charges upon each load of one and a half or two tons, has to be added, the hire of tarpawlings to secure in some degree the cargo from the spray of the sea; and also the pay of a watching peon whose presence in each boat is necessary to prevent the pillage which from the nature of the vessels employed, and the rough sea they navigate, the police cannot prevent by observa-

* B.

Total Tonnage of Vessels arriving at the Port of Madras for the year 1844 and 1855.

	Tonnage.		
	English and other Vessels	Country Vessels.	Total Tonnage.
From 1st Sept. 1843, to 31st Aug. 1844..	1,23,297	76,124	1,99,421
From 1st Jany. to 31st Dec. 1855	2,06,879	1,08,107	3,14,986
Increase ...	83,582	31,983	1,15,565

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tion from the land. The proposed Pier will reduce these charges to a comparative trifle, large boats worked by a few hands, aided by sails, will be employed between the Pier and the shipping, and if a guard is necessary at all, one man only will still be required in each boat however many tons she may convey. But the saving on these accounts, great as they will be, will not equal in amount the sum economized by the expedition with which vessels will be cleared of their cargo and reloaded. The loss by demurrage is now even greater than the charge on boat hire and the saving of time that will be effected by the Pier must tell most favorably upon the trade of the port. Another benefit that will be derived from the Pier, and one of great moment is that it will enable ships to obtain fresh water by means of their own boats; as pipes may be carried over the surf for this purpose and thus one of the great objections to Madras as a calling port will be removed.

Although the Pier will not be approachable at all times, suitable boats will in the opinion of the Committee be able to receive and deliver cargo under the shelter of the T head whenever they can be loaded with safety by the ship's side. The skill that is now so conspicuous in the management of boats in the surf, will soon be applied to the new description of vessel employed, and even when the weather is violent, communication will be held with the shipping in cases of emergency; besides greater facility being afforded for sending off anchors to ships in need. While the possibility of launching life boats from the end of the Pier in a severe storm, which could by no other means be taken over the surf at such a time will supply a desideratum that has long been sought for in vain. Making therefore due allowance for the days when the Pier could not be used for general purposes, the Committee still feel certain that its effect will be such as to alter entirely the character of the Madras port. And as the returns show that a charge of five per cent upon the outlay required, would hardly have amounted to 2½ Annas upon the tonnage of vessels that anchored in the Madras roads during the last year, they do not hesitate to say that the benefit to be anticipated from the work is such as to warrant the expenditure on its construction.

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The Committee have elsewhere stated it as their opinion, that such a Pier as is now proposed will be the best means of spanning the surf; they would now add that whatever improvement of the port of Madras may hereafter be undertaken, they are confident that it will be then admitted that the construction of a Pile Pier was the first step to be taken.

Before closing their report the Committee would venture to offer a suggestion that a proposal should be made to Messrs. Saunders and Mitchell that in the execution of the work two lines of piles connected by a platform should first be carried over the surf, and that the full breadth should afterwards be completed. The Committee feel confident that such a work would be sufficiently stable, and they observe from the Contractor's pamphlet upon screw piling, that its execution would be perfectly practicable. They admit that this mode of working would entail some inconvenience, and additional cost; but the value of such a Pier for a year or two, in the opinion of the Committee, would be well worth the difference in expense, for if this plan was adopted, an *immediate* benefit would be derived from the work. The Committee need hardly say that some limit in the time of execution should be entered in the specification.

Memorandum on the papers connected with the proposal for a Pier at Madras, by Colonel A. COTTON.

It appears from the Report of the Committee on this question, that they considered themselves called upon rather to give their opinion upon the practicability, cost and advantages of a Pier; and not to go into the greater question of what upon the whole it might be best to do at the present juncture for the improvement of the Port of Madras.

The points the Committee proposed to themselves for examination were,

1st, The practicability of a Pier on piles.

2nd. Its fitness, with reference to its effect on the Coast line, &c.

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3d. Its suitableness in form, &c.

4th. Its cost, &c.

5th. Its value, &c.

I propose therefore to consider the general question, viz., what under present circumstances it would be most advisable to do for the improvement of the Port of Madras.

I may observe that this is a question (that of the best mode of correcting the evils of Madras as a Port) which I have had before me for 20 years, and therefore I have had abundance of time to come to a decision on the subject, and of the main point I feel perfectly satisfied, viz., that a ship breakwater, consisting of a straight line of loose stones, similar to those at Plymouth, Portland, &c., and parallel with the beach, is the work that should be undertaken.

I therefore proceed to give my reasons for this conclusion; in respect of

1st. Its practicability.

2nd. Its effects.

3d. Its cost.

4th. The present circumstances.

1*st. Its practicability.*—Of this I suppose there can be no doubt in the minds of any in the least conversant with such matters. To throw a quantity of stones into the sea is certainly one of the simplest operations an Engineer can have to perform. But it is a point we need no guessing about, because we have the fact of many such works having been executed, and being now in progress in the most exposed situations that could be found in the world. After trying many fanciful modes of executing such works, engineers are now satisfied that nothing can be done beyond throwing a certain quantity of large stones down on a given line leaving it to the sea to throw them into such a form, as will bear its violence. In this way the breakwaters at Portland and Holyhead are now being formed. I need not attempt to answer here the various objections that might be started (as is universally the case) by persons entirely unconversant with such matters, because they are endless, but I may allude to one, because it has been so often suggested, viz., that such a work might be swallowed up in

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the bed of the sea; it might as well be suggested that it would perhaps float away, but our best answer to this is, that the boat breakwater which was begun in these roads and never finished, remains to this day. As to material, there is plenty of stone obtainable on the Coast at Covelong, on the line of the S. Coast canal generally, and on that of the Railway; as to the means of conveying it, it may be done as that for the boat breakwater was, that is, passed over the surf on Catamarans if not by any better means that may be proposed.

2nd. *Its effect.*—The effects of breakwaters are fully ascertained; they afford a perfect shelter for vessels in all weathers; under them, if there is good holding ground, vessels can ride out the most severe storms. As respects the communication with the shore, they preserve smooth water, and ensure perfectly convenient landing at all times, excepting perhaps during the height of a gale when a boat could not exist any where excepting close under the lea of some shelter.

But it by no means represents the true state of the case to say, merely that a breakwater forms a safe harbour; it should be remembered, that an artificial breakwater affords a harbour far superior to any natural one. There is probably not a natural harbour in the world, that has not some natural dangers connected with it, for reefs and islands do not appear only where they are wanted but too often just where they are not wanted· But in making an artificial harbour, artificial reefs are of course placed only where they will be useful. Thus an artificial reef parallel with the Coast at Madras would not have a range of sandheads with a stormy monsoon blowing direct upon them, and covered with breakers to seaward of it, warning ships off from the harbour behind them, nor would it have a five knots current within it, in which ships must anchor; nor would it have a Back-bay in which vessels might be lost, nor a stretch of 20 miles of water, over which if a hurricane blow, the ships at anchor might be dashed against each other, as they have been in Bombay. The port of Madras would be in every respect superior to those of Calcutta and Bombay. There would be no Pilotage, no time lost in running in or out at any time; and land-

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ing Piers might be constructed to any extent at a very small expense, and even carried out to where ships might be along side of them. In fact for all the great desiderata of a port; for convenience of access, for smallness of risk in and going out, for cheapness, and for security no port in the world would be superior to it.

Of course under the shelter of such a work, every thing in the way of wet-docks or other conveniencies of a port might be constructed as in any other harbour and any length of wharf of any kind might be constructed at a moderate expense.

I must however speak also of its "effects" upon the line of Coast. When lately in London, a Merchant Mr. Robertson the member for Hastings asked me about the possible improvement of the port of Madras, and when I suggested a breakwater, he put to me what I consider the most pertinent question in the matter, viz; would not the sand gradually extend out from the shore till it joined the breakwater. My reply is this; we need not theorize when we have facts; North of Madras we have two natural breakwaters, the Pulicat and the Armegon shoals, and these are both to this day unconnected with the coast at either end; this seems to me perfectly conclusive. These reefs differ indeed from the proposed breakwater in that they do not come above the surface of the water; but they are sufficiently near the surface for the main force of the swell of the sea to be expended on them instead of breaking on the shore and this I consider to be just the same, so far as the effect on the beach is concerned, as if they were above water.

As it is of importance that this paper should be as short as possible, I had better not go into detail about the motion of the sand on the beach. I will only say that it is caused by the surf striking the beach a little obliquely, so that the sand that is stirred up is always deposited a little to leaward of where it was taken up, and hence there is always a stream of sand moving along the coast, and if the surf were prevented by a breakwater, there would certainly be an accumulation of sand to windward of the point where the action of the surf ceased; this accumulation I believe

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would proceed, but more and more slowly as the deep water was approached till the current passing between the breakwater and it, was increased by the diminution of the channel, sufficiently to sweep away the sand as fast as the surf brought it forward, so that I conclude there would be an accumulation of sand on the beach to the Sd. of the breakwater, but from the example of the two shoals to the North, I feel satisfied that the passage between the end of the breakwater and the shore would never be closed. In the progress of things during the construction of the groynes, along the line of beach of late years, we have clear proof that the quantity of sand, in motion along the coast is not so very great, for since the number of groynes has been increased, extending as they now do for three miles along shore, the filling up between them with sand, has gone on very slowly, and it will probably be some years before the whole length of beach is extended much to seaward, though when there were only two or three groynes, the sand was deposited very rapidly. The only remaining effect that I believe the breakwater would produce on the line of the beach, is that somewhat to the Northward of the Nothern end, the beach would be cut away to some extent in consequence of the action of the surf upon it, while the sand removed by it, was not replaced by any surf under the lea of the breakwater, but this is of no importance.

I am thus perfectly satisfied that a breakwater would not have any injurious effect whatever on the beach.

3*rd. Its cost.*—The section which such a work will naturally take is now well known ; the inner slope is about an angle of 45° and the lower part of the outer one is the same. From a little above high water to a little above low water, the slope where the seas are excessively heavy is about 5 to 1, hence the cost of such a work very much depends upon the rise and fall of the tide. If this is great, both the work must necessarily be so much higher, and also the part on which the slope is so great must extend through a greater height, whereas in the present case, the rise being only 1 yard, the cost will be greatly diminished, as compared with such works in England. Further I feel assured that the force of the

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seas in this locality are far below those in that of the Plymouth breakwater for instance, which is exposed to the long continued gales that sweep across the wide stretch of the Atlantic. Our gales never continue many days, and in the hurricanes the wind never continues many hours in one direction. The comparatively small power of the seas is shown by the fact that after a hurricane, when the sea has risen above its ordinary level, very few stones are thrown up on the beach out of the bulwark.

"All experience tends to show that gales of wind and hurricanes have occured at intervals of several years and that there are timely warnings indicative of their approach and also that they are of short duration. For instance in the heavy gale of October 1842, the sea and surf raged with great violence from 8 A. M., on the 23rd to 2 A. M., on the 24th, yet at 6 A. M., within 24 hours from the commencement of the gale, and a few hours after its decline, the surf had so completely subsided, that boats and catamarans were enabled to ply."—Captain Biden.

Supposing that the work is placed in 6½ fathoms at low water, that the long slope extends from one yard below low water to 2 yards above high water, and that the top of the work is 4 yards above high water, the section would contain about 800 square yards, or 1000 tons per yard in length.

Such a work may be made of any length at first and extended as the trade of the port increase to any amount.

During the stormy season the number of vessels in the port will always be moderate, because the coasting trade is stopped, and during the fine season if all the vessels occasionally cannot be covered by it, they would still all have the benefit of the cheap, safe and convenient, communication with the shore that it would afford, so that as soon as a moderate length is executed all the main points will be gained. It must also be remembered that very soon when the coast canal is extended to the Godavery in the North, and the Cauvary in the South, the coasting trade will be greatly diminished, for the canal transit will be greatly cheaper than that by the coast. On these accounts 1000 yards length of breakwater will afford the

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main advantages which are sought, and if we estimate now for 2000 yards, we shall probably allow for enough considering the present trade, and it is one of the great advantages of such a work, that it may be carried out just as it is wanted, the length having nothing to do with the stability.

As to the cost per ton we have had some considerable experience at the Godavery and Kistna, were probably 1½ million tons have been quarried, and they have cost about 10 annas a ton on an average including carriage, partly along railways and partly by water, and the greater part of it with very imperfect apparatus. The quarrying here will probably not be more expensive from the appearance of the rock at Covelong, and superior apparatus would be used. With large blasts and powerful cranes, so that there will be little necessity for small charges, we know from the works at Portland and Holyhead, how very cheaply such work can be performed.

With respect to the crossing the surf, we have abundant proof how cheaply a small jetty can be constructed sufficient for such a purpose, in the way the *single* row of screw piles now extending 420 feet into the sea from the beach, has stood the late gales. It is quite clear that two such rows supporting each other would be quite sufficient to carry the stone to the back of the surf, if they extended to 600 feet from the beach at Madras. But I believe the best spot to obtain the stone at would be Covelong and the Seven Pagodas, where the surf is more moderate. At the former place there is a sort of cove formed by a projecting point of rocks, and also a reef detached from the shore, out of which probably a very good shipping place could be formed at little expense. There is there perhaps ¾ million tons of stone, which it would be worth while to take and the rest might be got at the Seven Pagodas. The distances from these places to the roads are respectively 20 and 30 land miles; and over this space the stone boats might be towed by steamers. It must be remembered that the number of stormy days in the year in this locality is very moderate, so that such work would not be interrupted in the way it is in England.

Bringing the stone in this way, I think if we allow 50,000£ for

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plant, viz. steamers, boats, rails, cranes, &c. for 1,200 tons a day and 1 Rupee a ton besides for quarrying &c., we shall be safe, and this would make 25 lacs for 2,000 yards,* and it might be extended at the rate of 1,000 Rupees a yard.

There are excellent data now for this sort of work in England from which allowing for the difference in the price of labor, very safe estimates may be made. But this seems quite sufficient to show that the cost of such a work would be very small compared with the vast objects in view. The interest at 5 per cent. would be 6⅔ annas (10 pence) per ton on the present tonnage (315,000 tons) or ⅕ per cent. on the reported present value of the imports and exports (711 lacs of Rupees). But these do not include the coasting trade, which strange to say, is not entered in any form in the Custom House returns.

The Pier Committee state that about 70 boats make an average of 4 trips in a day throughout the year, carrying each 2 tons or under, which would give about 150,000 tons a year shipped and landed at an expense of from 8 annas (12 pence) to upwards of 12 annas (18 pence) a ton, or perhaps 10 annas (15 pence) on an average, total 100,000 Rupees, besides Passengers. So that no doubt on the *present* traffic the interest of the cost of such a work would be saved in boat hire alone, leaving the diminution of risk and detention of vessels, that of pilfering and damage of goods in the boats, the time, convenience and safety of Passengers, &c. and

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* Rough Estimate of the cost of a Breakwater, 2000 Yards in length, for Madras Roads, in 6½ fathoms water.

	Rupees.
One Steam Tug of 100 tons burthen, and 40 Horse power, Rupees 35,000	
Six do.	2,10,000
One Stone Boat of 100 tons, Rupees 5,000	
30 do.	1,50,000
Waggons, Cranes, Rails, &c.	1,00,000
Jetty, &c., to facilitate loading boats, &c.	40,000
	5,00,000
Stone.	
2000 × 800 = 16,00,000 at 1¼ = 2 Mn. Tons at 1 Rupee including Sundries,	20,00,000
Total Rupees..	25,00,000

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those of all the future increase of traffic, as clear additional benefits.

The foreign trade increased 20 per cent. in the last year, and it is quite certain that as the internal improvement of the country in irrigation and cheap transit, and the wealth of the people are quite in their infancy, the trade of the Port of Madras is also yet quite in its infancy. We may safely infer that even if the present partial system of improvement of the country is continued, the trade of the port will be doubled and more likely quadrupled before a breakwater is finished, even if it is begun immediately.

At present the ordinary cost of conveying to the large vessels is 12 annas or 18 pence per ton, which is equal to fully 150 miles of carriage by the coast canal, so that a ton of goods from Tanjore would pay the same for conveyance to Madras by the canal as from the shore to the ship.

4th. Present circumstances.—The fact that the Hon'ble Court seriously consider the question of an expenditure of 100,000£ on a Pier at Madras shows plainly the nature of the times at which we have now arrived, and that to leave things any longer in the old state in this port is not to be thought of. In fact whatever it may have been in times past, the port is now totally out of keeping with the whole of the present system of management of the country. To spend 3 millions on a Railway, and as somebody well expressed it, to end it in a massulah boat, is altogether preposterous.

I think we may safely consider that all have now come to a decision on this point, and that something effective must be done to this important port. The question then is confined to this point, what is it to be? It is quite certain that the main points will not be attained by any Pier. It not only will not shelter the shipping, but it will leave even the landing and shipping of goods and passengers in a very imperfect state. There will be a great swell at the end of the Pier, which will be quite exposed to the sea; and most assuredly if ten lacs are spent upon it, there will even then be the same urgent demand for a breakwater as there is now, It is quite certain at least according to my judgment that an expen-

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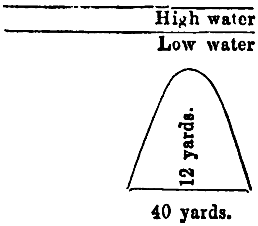
sive Pier of this sort, will be quite unnecessary after a breakwater is constructed. Indeed when Madras is situated on a sheltered bay (though an artificial one) the whole question of landing and shipping will have to be reconsidered, for it is evident that almost any thing may then be done in the way of wharfs, docks, &c., so that in my opinion it will be a most grievous mistake to spend, in fact to throw away 100,000£ upon a Pier, which would be totally unsuited to the new state of things, that would be caused by the execution of a work which may be done any day, which is certainly the only work that can make Madras a safe and effective harbour, and which will not cost so very much more than a Pier such as is contemplated. In fact we may go farther than that and safely say that if the same sum of 10 lacs were spent on 600,000 tons of stone, thrown down on a line of 2,000 yards in length, parallel with the beach in 6½ fathoms, forming a reef of a section of 300 square yards, or about 40 yards broad at the base and 12 yards high, that is reaching to within a yard of low water, it would be far more beneficial than a Pier, for it would certainly ensure almost smooth water for the ships, and entirely destroy the surf.



Such an artificial reef would effectually destroy the oscillation of the sea, which would break on it, instead of on the shore.

Hence to spend under these circumstances 100,000£ upon a Pier, when 250,000£ would *probably* be sufficient to make Madras much superior to any harbour now in India, and equal to any in the world, appears to me the greatest mistake, and if it is thought that such a work would cost more than ¼ million, it would not essentially alter the case, for it is certain that it would be far more economical to spend even half a million in making a harbour than 100,000£ in making a Pier. Five per cent on the latter sum would not be 1 Rupee per ton on the *present* tonnage, and really the present tonnage is no measure of the future tonnage. The mere formation of a harbour would itself have a prodigious effect on the trade, and the Coast

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Canal which is now so considerably advanced will alone go far to collect the produce of a great part of the Presidency to Madras. When once goods reach the Canal, the cost of bringing them to Madras even from 2 or 300 miles will be so little, probably not more than a Rupee a ton, that it will have a great effect on the trade, and when by means of improved rivers, branch canals, or even of cheap railways and common roads the whole interior is opened by cheap transit to the coast canal, the increase of trade will certainly be enormous.

But by no means the least important point in this question remains to be considered. The Railway which is now under construction is in a direct line from Calcutta and Madras towards London. Without a harbour at either end, and merely as a line connecting the E. and W. Coast of the Peninsula, I look upon this work, as one of the least important lines on which 3 millions could have been spent; assuredly nothing of any consequence either in goods or passengers will ever be conveyed by it from one coast to the other, and at least 200 miles of it are perhaps about the least productive line of country that a railway could be carried through in India. Further it is proved beyond all question that the passenger traffic is the main source of profit on railways, and that the great mass of passengers only travel a few miles (the average for all England is 13), that is, they go to the next town and back. Strange to say, this railway of 450 miles, is not to pass through one of the few towns (only 7 and all but one very small) which lie near its route, so that it looks as if the ultimate object had been to make a railway, not to carry the people. But if it is treated as part of the line of communication between London, and Madras and Calcutta, it then becomes a work of real importance though it is so defective as a local communication. It would save 4 days in the fine season, and 5 in the S. W. monsoon. In the latter season it would be so many hundred miles dead to windward. But to make it thus available, or at least to make it a thoroughly effective portion of the line from London to Madras and Calcutta, it must have a harbour at each end, and if 3 millions are spent on the road itself, it is surely worth while to spend ½ a million more in order so to complete it.

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Can it possibly be said while we are spending so many millions on the railways, that it is out of proportion to spend ¼ million on a harbour, at a seat of Government, and a place which is already a great commercial centre, notwithstanding almost every kind of hinderance, such as a want of internal cheap transit, an unsheltered roadstead, a heavy surf, &c. The exports from Coringa have increased seven-fold, since the improvements in irrigation and transit, although they do not extend beyond the little tract of country which forms the delta of the Godavery; what will they increase to when 50 times that extent of country is opened out by cheap carriage, and how surely the same thing will take place at Madras, if even the present partial system of internal improvement is persevered in.

I avoid going into any detail in this paper, respecting the construction of the work, as I think it would be quite out of place; I will only say that I feel assured that there will be no difficulty whatever in it, beyond what ordinarily occurs in executing works of magnitude. And it must particularly be remembered that a work of this kind may be carried to any extent and executed at any rate of progress that may be convenient. Five lacs or ten lacs a year may be set apart for it, and in the very first year, a material, nay an essential change, will be made in the port.

I conclude with earnestly requesting that these points may be thoroughly considered, and with recommending that this obvious, simple, and effective work may be at once undertaken. I append a chart* of the coast N. of Madras, showing the Pulicat and Armegon shoals. For thirty years it has been repeatedly proposed to use the shelter afforded by the latter as a Harbour, in connection with Madras. It has of course failed, because a harbour must be where the Commercial community are, and there is 100 times too much capital invested at Madras, in connection with the Port, to allow of the trade being removed to another site. We must either make

* Note.—In this chart the Pulicat shoal is incorrectly laid down as though there was no passage between its southern extremity and the main. Whereas it will be seen that in the plan marked in pencil the least depth is 5 fathoms as shown by the soundings.

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a city at Armegon, or a shoal at Madras, and the latter would perhaps not cost a twentieth part of the former, so that there can be no question which alternative to adopt. However all that has been written by many able men to show that an effective harbour exists under the shelter of the Armegon shoal, which is from 4 to 6 yards under water, goes to prove that Madras would be a harbour even before the Breakwater reached the surface of the Sea.

The Directors of the Assam Tea Company report that the outturn for 1855-56 amounted to 638,000lbs. The outturn for 1856-57 is expected to reach 700,000lbs. The company is, however, embarrassed by the difficulty of procuring labour. The Bengalees and Dangars are turbulent and ill-conditioned, and the Assamese alone are to be relied on. Their wages have been raised eight annas a month, but the supply is still deficient. Nothing is said about the financial position of the association.—*Allen's Indian Mail, April* 15, 1857.

NOTICES OF BOOKS.

Oriental.

Lieut. H. G. Raverty of the Bombay Army is bringing out a *Dictionary* of *the Pushto language* to consist of 40,000 words and to extend over 1,000 or 1,200 pages—also a *Pushto Text book* which will contain selected portions, Poetical and Prose, of the most celebrated authors carefully collated from M.S. copies in the author's possession. When it is known that Lieut. Raverty has been engaged over these works for the last nine years, and that he possesses probably a better knowledge of Pushto than any other European, we may feel certain that no labor has been spared in their compilation, and that they will fulfil the expectations of the most ardent linguist. A Pushto Grammar by the same author was published in 1856 and was noticed very favorably in the *Athenæum* of August 30, of that year, which says,

" Except the meagre *Vocabulary of Major Leech*, the *Chrestomathy* of *Prof. Bernhard Dorn*, and the short *Grammar published by Captain Vaughan* at

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Calcutta in 1854, no work has been written to facilitate the acquisition of this language, the Grammar, therefore, of Lieut. Raverty, which is sufficiently elaborate, and in which the rules are supported by copious and well chosen extracts from classical Pushtu authors, will be gladly hailed by every linguist."

As there are only a few copies of the Grammar remaining on hand, if he can procure 250 subscribers, Mr. Raverty intends publishing a 2nd edition* revised and improved to be ready at the same time with the Dictionary and Text book.

Another *Sanskrit Grammar* is announced from the Oxford Univerty Press by Mr. Monier Williams, Professor of Sanskrit at Haileybury; its design is to show the relation that exists between Sanskrit and the classical languages of Europe, and the facility with which Sanskrit may be acquired by Greek and Latin Scholars.

The Journal Asiatique, No. 32, for November and December 1856, reviews a book lately published, entitled "*Acar ussanâdîd.*" *Traces of important personages*, or *The History of Delhi and its Monuments, ancient and modern, by Saiyid Ahmed Khan, Delhi* 1854. The Reviewer says:—

"This monograph of Delhi by *Saiyid Ahmed Khan*, Magistrate of Delhi, and author of several other works also written in the ordinary language of the N. W. of India, is by far the most useful of any hitherto published in India in Hindustani (Urdu). The author informs his readers that his ancestors originally came from Arabia, that they subsequently inhabited Herat and came to India during the reign of Acbar. * * * * *

The principal and the only interesting portion of this volume is that which relates to the description of the ancient and modern monuments of Delhi. These as well as the inscriptions found on them are very faithfully illustrated by correct drawings which accompany the volume. * * * * *

The preface contains an abstract of the history of the Kings of Delhi, one chapter is devoted to the history of the Fort of Delhi built by Shah Jehan, and the other smaller fortresses of this town. Another chapter contains a detailed account of the different buildings erected by the Kings and principal people of the same city. The appendix is nothing more than an atlas containing sixty-five drawings of the buildings described in the work under notice."

The Journal Asiatique for January 1857, No. 33, thus announces the death of Mr. Von. Hammer, whose great work on Arabic Literature was noticed in our last number.* The following account of his last hours is given by his daughter:

* P. 270, Vol. I. N. S.

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Extract of a letter from the Baroness de Trenck de Tonder to M. Reinaud giving an account of her father's death. Dated Vienna 13th December 1856.

* * * "In the midst of his sufferings my father continued to busy himself with the studies which he had pursued during his long life. The day before his death when scarcely able to speak, he explained to me with much difficulty that he wished me to send to the Imperial Library for an Arabic work which he heard had just been published. Alas! he never cast eye upon it. He was constantly asking for books to read or calling for his secretary to write to his dictation. On the very last morning of his life, I was obliged in order to keep him quiet, to bring him paper and ink and to place a pen between his fingers with which he traced a few illegible words.

"During the last fortnight, the oppression under which he labored prevented his lying in bed. All that time he passed in an easy chair before his writing table in the middle of his Library. Such a place was little suited for the attentions which his state required. But we dared not change it. We saw too well that he wished to die surrounded by his books like a warrior on the field of battle.

"On the morning of the 20th November he received the holy sacraments. During the 23rd he was more restless and disturbed than usual. He continued however to write with his pencil on his handkerchief and on his linen; at length he began to doze. We listened with thankfulness to his quiet and regular breathing. Twice or thrice he clapped his hands, a mode of calling his servants he had acquired from his travels in the East. On drawing near however we found him still in the same tranquil sleep. About a quarter past six a deep sigh drew our attention to him; another followed; it was the last!

"I must add a few words relative to the state in which my poor father has left the works in which he was engaged The seventh Volume of the History of Arabic Literature is quite finished, and will be shortly despatched to the individuals and to the Scientific Societies which have received the preceding Volumes. The reflection that he had completed this Volume was a source of great comfort to my father and he has left me full instructions for its distribution. He has expressed a hope in his will that the Imperial Academy will complete what is considered indispensable to the work, at least as far as regards the tables. M. Pfitzmaier is engaged in the revision of the second Volume of the Persian chronicle of Wassaf. I feel sure that the respect due to the memory of the Translator and Editor will prevent any delay in completing this publication which, you are aware, is carried on under the auspices of the Imperial Academy.

I shall not astonish you, Sir, who know the indefatigable application and the immense labors of my father when I tell you that his repositories contain numerous writings in his own hand of which, unfortunately, the characters are for the most part, almost illegible. I need not say that I feel it to be a sacred duty to have these MSS. arranged by a skilful person, to whom, I trust, my practice in deciphering my father's writing, will prove of some use."

M. Reinaud adds in a note that M. de Hammer long ago completed a Translation in French of the Arabian tale of *Antar*. Some years since, the elder M. Pou-

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joulat being at Vienna, received the MS. from M. de Hammer for publication in Paris. It is understood that this publication will not be much longer delayed.

Natural History.

A paper on the metalliferous deposits of Kumaon and Gurhwal by W. J. Henwood, late Chief Mineral Surveyor in the N. W. Provinces, which was read before the R. Geological Society of Cornwall has appeared in the last No. of the Edinburgh New Philosophical Journal.*

Mr. Henwood met with copper pyrites and purple copper ore in quartzose veins occurring sparingly in the granitic and gneiss formation and somewhat more plentifully at the junction of the talc and clay slates of Poker, Seera, &c.

Iron ores occur in great abundance throughout the clay slate formation and in some parts of the talc slate series. Mr. Henwood particularly notices the fact that *bunches* of ore dip from the mass of the nearest granite formation not only in the case of the iron of the Himalayas but as regards the gold of Brazil.

The talc slate formation he found to exhibit a strong resemblance to the gold districts of Brazil particularly to the Jacotinga formation in which the richest gold deposits occur. Accordingly he found that gold mines were actually worked in Kumaon and Gurhwal, but in the rudest and most inefficient manner. The usual method of preparing the rock for being worked was to soften it by the application of fire.

" †But in their small and ill-ventilated mines this mode is very ineffective, while the smoke and foul air, generated by the combustion, stop the work of every other person in the mine at the time. The imperfection of the tools and mode of working ; the ignorance which prevails of the advantages of ventilation; of the economy of labour, by extracting the ore through passages large enough to allow the workmen unimpeded action; as well as the native smelter's inability to treat any but the richest and most fusible ores; render it, therefore, an object of paramount importance, in the view of the Indian miner, to avoid, by every possible device, the opening of large galleries. But the softer and more fusible ores are far less plentiful than those which are too refractory for the native smelting furnace; and the two varieties of ore are so intimately mixed in

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* No. I. Vol. III. new series—1856.

† Do. do. p. 139.

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the beds, that it is impossible to extract the former without breaking still larger quantities of the latter also. In order, therefore, to obtain a supply for their furnaces, as well as to allow the miner the free use of his tools, large excavations are made, and a selection of ores, as far as practicable, is made under ground, and that which is too refractory for use is heaped up within the mine, to such an extent as scarcely to allow sufficient convenience for the exit of the miner, and the removal of the ore. The ordinary mode of extraction is in bags of skin, tied to the person of the labourer, who crawls, when possible, on *all fours*, dragging the bag after him over the rough floor of the opening. But in many places the opening is too strait even for this, permitting passage only in a prostrate position, the sufferer propelling himself by writhing, and by the aid of his elbows on the sides and of his toes on the floor of the hole. In one mine, indeed, the opening is so small, except in the part wrought under the Goorkha rule, that we found children of only from 10 to 14 years old employed in the difficult and dangerous task of re-opening a communication through fallen rubbish in a gallery of which the sides were broken down."

M. Hasskarl, Superintendent of the Botanical Garden at Buitenzorg, and the successful introducer of the Cinchona into Java has been compelled to return to Europe for the recovery of his health. But before his departure he had commenced two works descriptive of the Flora of Java, one entitled,—

RETZIA *sive observationes botanicæ quas de plantis Horti Botanici Bogoriensis annis* 1855-56 *fecit* J. K. Hasskarl: and the other,—

OBSERVATIONES BOTANICÆ *de* FILICIBUS *Horti Bogoriensis et ad montem Gedeh sponte sua crescentibus, &c.*

It is stated however that it is his intention now to embody all his observations in a single work to be entitled *Hortus Bogoriensis Descriptus* with notices or descriptions of about 600 species.—*Kew Misc.* IX. 196.

Miscellaneous Notices.

Among the new works upon Eastern subjects that have made their appearance within the last year or so, *The Kingdom and People of Siam, with a narrative of the mission to that country in* 1855, by Sir J. Bowring, F. R. S., H. M. Plenipotentiary in China, 2 vols. 8vo. 326, stands pre-eminent perhaps for interest and utility in a commercial and political point of view. At the same time it is gratifying to find that India has made some important contributions. *The personal narrative of a Pilgrimage to El Medinah and Mecca,*

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by Captain Burton, Bombay Army, has already attained a second edition. Captain Burton has also written a History of Sindh, and has proved himself possessed of energy and observation which, coupled to his intimate acquaintance with the various dialects of Arabic and Persia, rendered him peculiarly fitted to undertake the pilgrimage of which he has given us so interesting a narrative.

A valuable work from the pen of a member of the Madras Medical Service has just been published, under the title of *The Antiquities of Kertch and Researches in the Cimmerian Bosphorus; with remarks on the Ethnological and Physical History of the Crimea;* by Duncan Macpherson, M. D., of the Madras Army, Folio, and Colored engravings, Two guineas. Some of the early proof plates of the antiquities were exhibited at our meeting in March last, and attracted much admiration. The notice of them will be found at page 284, Vol. I.

More recently has been announced *A Journal of two years' Travel in Persia, Ceylon, &c.* by Robert Binning, Esq., Madras Civil Service, 2 vols. 8vo. 28*s*. (Allen and Co).

The *Athenæum* of April 18, 1857, p. 496, concludes a favourable review of Mr. Binning's work in these words,—

"After this general picture, we might draw attention to many valuable details in Mr. Binning's work, but we shall content ourselves with saying that it will be found a book of reference as to measures, dress, household matters and statistics. The author's opinions on Persian literature are especially valuable. A man who has read through the 60,000 couplets of Firdausi, most of the lesser poets and a more than usual quantum of historical and doctrinal works, is entitled to speak *ex cathedrâ* on Persian writings. Classical scholars may, indeed, be disposed to demur to an authority who places the Sháhnámah above the Iliad. There are many points of comparison between Homer and the Persian Epic Poet; but we shall not enter upon the parallel, which would form a good subject for a separate essay, and would require a book to itself. One coincidence, however, may be noticed, as to the martial enthusiasm the verses of both poets inspire. "The Persian soldiery," says Mr. Binning, "when about to engage in combat, are accustomed to sing aloud certain passages of the Sháhnámah, which practice has the effect of inspiriting them to absolute fury; as the verses of Homer did the warriors of Greece, or as the Runic lays of the Skalds were wont to animate the fierce Berserkars of old Norway." Leaving the stout partizan of the Homeric cause to take up Mr. Binning's glove, we close the volumes in which the challenge is recorded, with a hint to the Greek champions that they may perhaps in this encounter find harder work than in the old fields of Marathon and Salamis."

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Christianity in China, Tartary and Thibet; by M. l'Abbe Huc, 2 vols. (Longman and Co.) has just made its appearance and gives a History of the propagation of Christianity in those parts. "If it should not" says the *Athenæum*, (April 25, 1857) "be accepted as philosophically impartial, it will at least enjoy the credit of being thoroughly interesting."

Les Anglais et l' Inde; by M. le Mor. Fridolin, which has appeared in the last few numbers of the *Revue des Deux Mondes* is concluded at page 298 of the *Revue* for the 15th March last, vol. VIII.

Mon. Fridolin has divided his subject into five parts and treated them in the following order.

1. Les Fonctionnaires civils de l' Honorable Compagnie des Indes. (Vol. VI. p. 301.)

2. L'Education des Hindous, les prisons et les Moyens de repression contre les Khonds, les Thugs et les Datturias.(Vol. VII. p. 768.)

3. Le Commerce, les Finances et les Travaux publics sous le Government de l'Honorable Compagnie. (Vol. VII. p. 357.)

4. L' Armee Anglo-Hindoue, Mæurs et Scénes Militaires dans l'Inde. (Vol. VII. p. 721.)

5. Les Grandes villes de l'Inde, deux mois sur le Great Trunk-Road. (Vol. VIII. p. 241.

The death of Dr. Robert Ball, Secretary of the Royal Zoological Society of Ireland is thus reported by the *Athenæum* of the 18th of April, p. 505.

"From Dublin we hear of the sudden death of Dr. Robert Ball,—an esteemed Naturalist, whose name was recently brought under the reader's notice in connexion with the arrangements for the next meeting af the British Association. Dr. Ball was born in 1802. He succeeded the late Dr. Whitly Stokes as Director of the Museum in Trinity College. On the establishment of the Queen's University in Ireland, in 1851, he entered on the additional duties of Secretary of the Joint Committee of Lectures in connexion with the Department of Science and Art; and in 1855 he was nominated Assistant-Examiner for Ireland to the Civil Service Committee. While holding these several appointments he was an active member of most if not of all the scientific Societies of Dublin. He is best known as Secretary of the Royal Zoological Society of Ireland and as Treasurer of the Royal Irish Academy,—an officer next in corporate rank to that of President. In 1850

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the University of Dublin conferred on him the honorary degree of LL.D. His published papers are scattered through the pages of different periodicals. Three have appeared in the Transactions or Proceedings of the Royal Irish Academy, viz., 'On the Species of Seals (Phocidæ) inhabiting the Irish Seas,'—'On the remains of Oxen found in the Bogs of Ireland,'—and 'On the Cephalopoda of the Irish Seas.' That he was at all times ready to impart his information freely to others, most of the zoological works published in these kingdoms during the last few years afford ample testimony."

Dr. Ball's books and collections are announced for sale in Dublin.

Since the issue of our last number, Mr. Prendergast has finished his task, and we have now *A complete Concordance of the Poetical Works of Milton.* The Concordance extends over 416 closely written quarto pages, and some idea of the patience it must have made trial of may be formed by referring to words like '*such*,' and '*though*,' the former of which we can now assert (on Mr. Prendergast's authority) that John Milton has repeated 256 times and the latter 273 times in his Poetical writings.

The Concordance has been made, it is said, "from the Edition by Sir Egerton Brydges, in 6 vols. 12mo. printed by Macrone, St. James Square, London, 1835; but of course the references in respect of *Books* and *Lines* are applicable to any Edition."

The work came out in 12 parts, 2 Rs. each part, and was printed by Messrs. Pharoah and Co., at the *Athenæum Press*, Madras.

The Rev. R. Caldwell whose *Comparative Grammar of the Dravidian Tongues*, and whose lengthened labours as a Missionary in the South of India were noticed in our last number,* has had the honorary distinction of LL.D. conferred upon him by the Glasgow University.

Lieut.-Gen. John Briggs, F. R. S., of the Madras Army, has just issued a popular view of the present state and future prospects of the Eastern Continental Empire entitled *India and Europe compared.* (Allen and Co.)

Chapters 1 and 2 are devoted to establish the identity of the races as evinced in four peculiarities belonging to both and to no other race of men. The area and population of India is also given.

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* p. 271, Vol. I.

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The remainder of the book, some 230 pages, is a statistical Comparison of the Military and Financial resources of the two countries, their Commerce, Public Works and Educational Systems.

PROCEEDINGS.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening, the* 9*th April,* 1857.

The Secretary laid before the meeting the usual monthly Statement of the Society's Funds.

Read a paper communicated, through the Honorable Walter Elliot, Esq., by the Revd. Mr. Percival, *on the Tamil Epic the Chintamani.*

After a few observations on the late Educational scheme introduced into India, Mr. Percival alludes to the general satisfaction caused by the Vernaculars, instead of English, as was at first apprehended, being made the medium of instruction to the masses. He briefly points out the increased attention the Dravidian Tongues are attracting at the present day, both among Oriental Scholars in England, and on the Continent of Europe.

That such is indeed the case, were other evidence wanting besides the several Publications which have lately appeared in connection with India, its Literature and Language, is sufficiently proved by the fact that one or two Works in Tamil beautifully executed have issued from the Press in Europe.

Under such circumstances Mr. Percival ventures to remind us of the benefits that are likely to arise were we to direct our attention to some of the ancient works of Southern India, which for centuries have been acknowledged by the Natives as Authorities, and have earned the admiration of their best scholars. There are five Classical Works he says answering to this description, and which are reckoned of undisputed authority in all matters relating to Tamil Philology.

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1. The Chintamani. 2. Chillapadikaram.
3. Valleiyapathi. 4. Kundalakèsi.
and, 5. Manimèkalei.

For the subject of the paper under notice he has chosen the Epic Chintamani composed by Terudevar. In regard to the action of the Poem, and the incidents essential to its development, it is little more than a Narrative of the fabulous acts of prowess and skill of a King called Jivaka.

Independently of this however, Mr. Percival, whose acquaintance with Tamil Literature is most extensive, states that the Poem throughout exhibits such literary talent and is interspersed with remarks involving such keen *retrospection* into the grounds of human action, that it amply sustains the high character he claims for it. In respect of its views it is peculiarly the Text Book of the Jains, and supports, with care, their various doctrinal peculiarities. For the characteristics of the Jains as compared with the Buddhas and Brahmins, vide Bombay Transactions, vol. 3, page 506. Though Mr. Percival has thus pioneered the way, as it were, in this brief notice of one of the five Classical Works in the Tamil Language, we cannot but hope that he will find time to give us some account of the remaining four, more particularly so when we consider that his extensive acquaintance with the Oriental Tongues fits him in a peculiar manner for the highly interesting task.

The Committee acknowledge with thanks the receipt of the following Reports, &c. from the *Chief Secretary.*

1. Mr. Herman Schlagentweit's Observations in Upper Assam, &c. from January to May 1856.

2. Mr. Robert Schlagentweit's Report on the progress of the Magnetic Survey of India from November 1855 to April 1856.

3. Copies of Reports V, VI, VII, VIII & IX, of the Proceedings of the Officers engaged in the Magnetic Survey of India.

The Society possesses Copies of Reports V, VI, VII & IX, received from the Chief Secretary and acknowledged in last month's Proceedings. No. VIII. was printed at Agra instead of Lahore, and some delay occurred in its issue.

4. Annals of Indian Administration, Part 1,

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5. India, No. 17—Reports on Mineral Deposits in Kumaon.

6. India, No. 20—Reports on Pegu, Tonghoo, and Salween, also Major Jacob's complaint against the Punjaub Board.

7. Selections from Madras Government Records—Correspondence regarding the Railway.

8. Second Edition of Dr. Baikie's account of the Neilgherries—with 5 Plates in Tin Case.

9. Report on the Elliot Marbles by the Revd. W. Taylor.

Received by order of the Right Honorable the Governor in Council at Bombay, the Bombay Magnetical and Meteorological Observations for 1854 and 1855.

Received from the Smithsonian Institution the Smithsonian contributions to Knowledge, Vols. VII and VIII, and the Eighth Annual Report of the Board of Regents of the Institution for 1853 and 1854.

Received, through the same source, a Prospectus intimating that Professor *Agassiz* intends publishing, in a series of ten quarto Volumes, the principal results of his extended investigations in the Natural History of North America. It is proposed to print the Prospectus in the fly leaf of the next number of the Journal, and the Committee desire to warmly recommend the work to the lovers of science throughout the Presidency.

The Committee also take this opportunity of acknowledging the receipt, from the Smithsonian Institution, of the Constitution and Bye-Laws of the *New Orleans Academy of Sciences*, which came accompanied by Vol. I, No. 1, of the *Proceedings of the Academy.*

In accordance with a wish expressed by the Members of the New Orleans Society, the Committee will have much pleasure in effecting an interchange of Scientific Productions with them.

The Committee also acknowledge with thanks the receipt from the Honorable Walter Elliot, Esq., of Volumes 9 and 10 of De Candolle's Prodromus Regni Vegetalis. As the Society is already in possession of the first 8 Volumes of the work, it was resolved that the succeeding Volumes be purchased, as they are, or may be, completed.

The Meeting separated a little before 8 o'clock.

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The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening the* 14*th May* 1857.

The Honorable Mr. Elliot, read a letter from Dr. Jamieson of Saharunpoor, announcing the dispatch of specimens of Himalayan Teas, for the Madras Exhibition. Unfortunately they have not yet arrived, having been forwarded from Calcutta in a sailing ship, and meantime the Exhibition has closed. The Indian Teas are represented as being in much request at the periodical Auction Sales, and as realizing good prices. The Black Teas fetch from annas 15½ per lb. for Pouchong, to Rupees 1-15-8 for Souchong. The Green Teas from Rs. 1-15-8 for Pekoe to Rs. 3-4-9 for Gunpowder and Hyson. In preparing the Green Tea no colouring matter is allowed. The color and flavor are brought out entirely by manipulation in cast iron pans. The quantity of land under the cultivation is about 1,600 acres annually. Upwards of a million young seedlings and 20,000 lbs. of seeds are distributed gratis to private individuals, to enable them to form Plantations on their own account. The Tea Plant is now cultivated from the Kalee River in Kumaon to the Indus, or over 4° of Latitude and 6° of Longitude. It has also been introduced with success at Darjeeling.

Dr. Jamieson also forwards specimens of Woodcutting, for which Saharunpoor is famed. The woods used by the Engravers are Doodia, Wrightia, Nauclea parviflora, &c.

An interesting letter from Dr. Drew was likewise read, giving an account of his search for the Gutta Percha Tree of Wynaad. He met with it very abundantly in some places, every fourth tree being of this description. It is plentiful in the middle third of the Karkoor pass, more rare near Davilcotta, and disappears higher up; but it is said to be found immediately under the Nelagiri Peak. The tree is large and lofty, so tall indeed, that it is impossible, with the naked eye, to distinguish clearly the form of the leaves, and were it not for the fruit and flowers lying on the ground, to know that the tree was in flower. Dr. Drew doubts whether the tree is isonandrous, and from a careful drawing and description transmitted, it is clear that it does not fall under that genus as charac-

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terized by Wight and Griffiths. The Pachounti, which was sent to the late Exhibition from Travancore appears to differ both from the Wynaad species and from the true Isonandra Gutta. The whole group call for careful revision.

The Secretary read a letter from Lieut. H. G. Raverty, 3rd Bombay N. I., Assistant Commissioner Mooltan, enclosing Prospectus of a Dictionary and Text Book of the Pushto language, which he has been engaged upon for the last nine years. Lieut. Raverty has already published a Pushto Grammar, which was favorably noticed in the *London Athenæum* of August 30th, 1856. Should 250 copies of the latter be subscribed for, he intends publishing a second edition, revised and improved, at the same time with the Dictionary and Text Book.

Resolved, that the Society take one Number of each Work, and that the Prospectus be published in the Journal.

Read a letter communicated through the Honorable Mr. Elliot, on the subject of Colonel Stacey's magnificent collection of Coins.

Captain Wroughton, on behalf of the daughters of Colonel Stacey, has offered the Coins for sale at Rupees 5,000, and the Council of the Asiatic Society of Calcutta, impressed with the importance of securing so valuable a collection, have resolved to call on all interested in Indian Archeology to aid the Society in their efforts to preserve the collection in its integrity, and to deposit it in a place accessible to all Numismatists.

The Committee acknowledge with thanks the receipt of the following contributions :

From the Chief Secretary.

1. Report of the Committee appointed to examine Messrs. Saunder's and Mitchell's project for erecting an Iron Pile Pier at Madras.

2. Report of the Committee upon Captain Taylor's proposed Pier.

3. Memo. of a project of a Ship Breakwater for Madras, by Colonel A. Cotton, Madras Engineers.

4. An account of the fall of two Meteoric Stones in the District

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of Madura on the 28th of February last, by the Rev. H. S. Taylor, an American Missionary.

From Colonel Browne.

5. Observations on Free Labour Cotton in the West Indies, by James Banks, late of Honduras.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening,* 11*th June,* 1857.

The chair was taken at ½ past 6 by the Honorable Walter Elliot, Esq.

The Secretary laid the usual statement of accounts before the Meeting, and brought to the notice of the Committee that the Rules for the Society's Management being nearly out of print, a fresh batch of them would have to be printed, and might be taken in hand at the same time with the Catalogue now under revision, and almost ready for the Press.

Resolved that the statement is satisfactory, and that fresh copies of the rules be printed as suggested.

Read a letter from Colonel Balfour, C. B., which was ordered to be recorded.

The Committee beg to acknowledge the receipt of the following papers from the *Chief Secretary.*

1. Observations on Provincial Exhibitions and the improvement of the Resources of the several Districts of the Madras Presidency, by J. Forbes Royle, M. D.

Dr. Royle expresses great satisfaction at the successful results which have attended the attempts to develop the natural resources of this Presidency. He points out the particular objects which should be kept in view with regard principally to procuring markets, to the introduction of new Articles of Produce, of superior implements of husbandry, the improvement of the breeds of Cattle, &c.

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This valuable paper was communicated to the Sub-Committee of Papers and will appear in the forthcoming Number of the Journal.

2. No. X. of the Report of the Officers engaged in the Magnetic Survey of India.

The Committee also acknowledge with thanks the receipt of a Catalogue Raisonne of the Books in the Medical College, presented by the College.

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Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

DAILY MEANS.

March 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·914	76·3	70·1	86·9	68·2	E S E	....	Clear
2	·926	78·5	72·4	89·0	72·6	E S E	....	do
3	·911	79·2	73·6	88·3	72·7	E S E	....	do
4	·927	78·6	73·7	88·8	72·4	S E	....	do
5	·941	78·3	72·8	87·7	72·0	S E by E	....	do
6	·908	78·2	71·7	89·0	70·7	S E	....	do
7				88·9	72·9	S E by E	....	
8	·883	81·3	75·4	90·1	78·6	S E by E	....	Hazy
9	·831	81·5	76·0	90·2	77·2	S S E	....	do
10	·868	81·7	76·3	90·9	77·0	S S E	....	do
11	·899	81·9	76·8	89·7	77·3	S E by E	....	do
12	·964	81·5	75·4	90·0	76·4	E S E	....	do
13	·986	80·5	74·5	88·6	75·1	E by S	....	Clear
14				88·9	73·2	E	....	
15	·906	78·7	72·2	87·5	72·6	E	....	do
16	·934	77·9	71·8	87·9	72·1	E	....	Hazy
17	·922	77·6	71·7	86·9	72·0	N E	....	do
18	·906	78·6	72·1	90·2	71·4	S E	....	Clear
19	·894	78·9	72·4	92·7	71·1	S E	....	do
20	·856	80·1	72·8	92·2	72·4	S E	....	do
21				90·9	74·3	S E	....	
22	·854	81·0	73·6	92·3	74·3	?	....	do
23	·849	79·3	72·3	89·7	72·6	S [illegible] E	....	do
24	·854	80·7	74·8	90·3	75·9	S	..	do
25	·887	81·5	75·7	90·8	76·0	S	0·099	do
26	·915	83·2	77·9	92·9	78·3	S	....	Hazy
27	·852	83·1	77·9	92·7	77·2	S S W	....	Clear
28				96·9	76·8	W S W	....	
29	·800	81·4	75·9	92·9	73·4	S W	....	do
30	·838	82·7	77·1	92·2	77·2	S W	....	do
31	·875	82·0	75·5	92·6	75·2	S W	....	do
Means	29·896	80·2	74·2	90·2	74·2		0·099 Sum	

April 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·849	80·7	74·9	91·3	73·5	S W	....	Clear
2	·860	81·8	76·4	92·2	75·6	S W	....	do
3	·879	82·0	76·2	92·0	76·4	S S W	....	do
4				93·1	75·6	?	....	
5	·887	82·9	76·7	92·2	77·3	S S W	....	Hazy
6	·897	83·5	76·4	94·9	78·5	S S W	....	do
7	·897	82·3	76·2	92·0	78·7	S S W	....	do
8	·881	83·2	76·9	96·7	76·7	S W by S	....	do
9	·854	84·6	78·6	94·0	79·1	S W	....	do
10	·851	84·4	78·1	93·2	78·8	S S W	....	do
11				94·0	78·1	S S W	....	
12	·837	84·1	77·0	93·7	77·5	S S W	....	Clear
13	·835	85·0	77·7	96·9	78·5	W S W	....	do
14	·838	86·5	78·5	98·4	81·5	W S W	....	do
15	·784	86·9	79·9	100·7	81·8	W S W	....	do
16	·740	87·4	80·6	100·4	83·2	W S W	....	do
17	·774	86·9	80·9	97·0	83·4	W S W	....	do
18				94·6	81·9	W S W	....	
19	·792	85·9	80·1	95·1	81·0	S W	....	do
20	·792	85·5	79·0	94·8	81·0	S W	....	Hazy
21	·799	85·1	78·6	94·2	80·1	S W by S	....	Clear
22	·814	84·4	78·4	92·6	79·5	S W	....	Hazy
23	·807	84·7	79·0	94·3	79·7	S S W	0·123	do
24	·822	84·8	78·3	93·9	79·3	S	....	do
25				94·8	79·8	S	....	
26	·834	85·4	78·6	95·1	79·8	S	....	do
27	·829	85·3	78·5	94·7	79·6	S by W	....	do
28	·814	86·6	78·9	96·1	82·9	S by W	....	do
29	·794	86·5	79·2	97·7	82·0	S	....	Ovcst.
30	·793	85·6	78·7	94·8	80·6	S S W	....	Hazy
31								
Means	29·829	84·7	78·2	94·8	73·7		0.123 Sum	

May 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·801	86·3	78·5	96·5	82·2	S S W	....	Hazy
2				97·6	81·8	?	....	
3	·739	85·8	79·3	96·6	79·2	S W	....	Cldy.
4	·744	86·2	[illegible]	97·9	79·9	S S W	....	Hazy
5	·751	86·5	79·9	97·0	83·2	S W	....	Cldy.
6	·766	86·3	79·6	97·9	80·7	W S W	....	Hazy
7	·727	87·6	79·0	100·4	81·8	W S W	....	Cldy.
8	·658	89·5	79·6	105·3	84·2	W	....	do
9				105·2	80·7	N W	....	
10	·729	88·5	78·7	104·1	83·7	W	....	do
11	·772	89·0	78·8	103·5	83·1	W	....	do
12	·769	88·6	78·0	98·6	83·6	?	....	Hazy
13	·771	89·0	78·2	102·3	83·8	W S W	....	Clear
14	·748	89·4	78·2	104·9	83·2	W S W	....	Hazy
15	·743	87·9	77·4	98·4	81·9	?	....	do
16				101·2	84·1	W	....	
17	·729	90·5	78·8	106·0	84·8	S S W	....	do
18	·727	91·2	78·5	106·6	85·1	W	....	Clear
19	·734	92·8	76·9	106·3	86·8	N	....	Cldy.
20	·734	91·9	77·2	103·9	86·9	W	....	Ovcst.
21	·723	85·5	75·5	92·6	81·9	W N W	....	do
22	·719	84·7	75·5	100.6	80.2	N N W	0.032	Cldy.
23				104·0	83·5	W N W	....	
24	·722	83·0	77·1	102·3	83·8	N W	....	do
25	·724	89·4	77.2	104·9	84·9	W N W	....	do
26	·690	90·3	75·7	102·9	85·2	W	....	do
27	·653	92·4	75·5	105·0	84·7	W	....	do
28	·664	92·1	75.3	103·9	85·0	W	....	Hazy
29	·689	89·8	75·5	97·1	84·7	W N W	....	Cldy.
30				98·7	82·1	?	...	
31	·712	87.3	77·7	101·2	82·4	W	·026	do
Mean.	29·728	88·7	77·7	101·4	83·2		0·058 Sum	

? This mark signifies that no Means can be taken owing to the variable state of the Wind.

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Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen Mean Time	Noon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Means.
Madras Mean Time	h m 4 41 P. M.	h m 5 41	h m 6 41	h m 7 41	h m 8 41	h m 9 41	h m 10 41	h m 11 41	h m 12 41	h m 13 41	h m 14 41	h m 15 41	h m 16 41	h m 17 41	h m 18 41	h m 19 41	h m 20 41	h m 21 41	h m 22 41	h m 23 41	h m 0 41	h m 1 41	h m 2 41	h m 3 41	
Barometer at 30° Faht 1857	In.	In	In.	In.	In,	In.	In.	In.	In.	* In.	In.	* In.	In.	In.	In.	In.	In	In.	In.	In.	In.	In.	In.	In.	In.
Mar	29·836	28·946	29·867	29·889	29·909	29·923	29·922	29·912	29·897	29·885	29·877	29·873	29·881	29·897	29·917	29·940	29·958	29·963	29·952	29·924	29·897	29·868	29·846	29·834	29·896
Apr	·764	·776	797	·821	·842	·860	·860	·850	·832	·815	·804	·802	·811	·829	·849	·873	·892	·892	·879	·861	·830	·802	·779	·767	·829
May	·662	·676	·697	·722	·745	763	·765	·757	·741	·723	·710	·707	·717	·735	·757	·775	·782	·781	·765	749	·722	·696	·672	·659	·728
Dry Ther. 1857	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Mar	84·6	82·5	80·7	79·9	79·3	78·6	77·9	77·0	76·0	75·2	74·5	74·0	73·5	73·3	73·6	77·8	81·5	84·2	85·9	86·7	87·2	87·1	86·8	86·0	80·2
Apr	88·1	86·0	84·1	83·3	82·9	82·5	82·1	81·7	81·2	80·5	79·8	79·3	78·7	78·3	80·6	84·2	86·9	89·3	90·2	91·2	91·2	90·9	90·4	89·3	84·7
May	92·1	89·4	87·1	86·6	86·2	85·6	85·4	85·0	81·6	81·1	83·6	83·2	82·7	82·6	84·9	87·7	90·7	92·9	95·0	96·3	96·6	96·5	95·9	94·4	88·7
Wet Ther. 1857																									
Mar	75·8	75·2	74·7	74·5	74·4	74·2	74·0	73·6	73·0	72·5	72·1	71·8	71·4	71·3	71·7	74·2	75·2	75·6	76·0	75·9	75·9	75·7	75·6	75·8	74·2
Apr	79·2	78·8	78·2	78·1	77·8	77·8	77·7	77·5	77·3	77·0	76·7	76·4	76·1	75·8	77·1	78·4	78·9	79·0	79·3	79·8	80·0	80·0	79·7	79·4	78·2
May	79·2	79·2	78·9	78·7	78·3	77·7	77·4	77·1	76·5	76·2	76·0	75·7	75·4	75·3	76·4	76·9	77·6	78·0	78·5	78·7	79·2	79·6	79·5	79·3	77·7

* The Numbers in these Columns are not observed but interpolated for the sake of obtaining the daily means.

MADRAS,
9th July, 1857.

W. S. JACOB,
Hon'ble Company's Astronomer.

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MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

NO. 4.—NEW SERIES.

July—September, 1857.

VII. *On the Relationship existing between the Animal and Plant. By* GEORGE BIDIE, M. B., *Assistant Surgeon, Madras.*

Between the animal and plant of the higher orders there is such an apparent difference of conformation, such a contrariety of habits, that the mere casual observer will fail to recognise those secret links, by which nature binds all her works into one harmonious whole. In whatever direction however the contemplations of the naturalist tend, from race to race or from kingdom to kingdom, he discovers no rude gaps but a beautiful unison, for *nihil per saltum* is one of the great laws of creation. If we descend the scale of nature, reaching the extreme boundaries, the lowest forms, of the animal and vegetable kingdoms, we find members of these great divisions approximating so closely, that it becomes a matter of difficulty to draw any line of demarcation. The limits here are also hazy, because so far beyond the ken of unaided vision, and although the microscope has unveiled nature's secrets, disclosing a new world grand in the plenitude of its minutiæ, still its scientific eye is finite failing at times to decide which is the animal, and which the plant. It has been said that " stones grow, vegetables grow and live, and animals grow, live and feel," but this axiom is not sufficiently extensive in the terms of its definition. Thus plants in some instances seem capable of distinguishing between light and darkness, for

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many only open their leaves or flowers to the sunshine, while others the *plantæ tristes*, the watchmen of the flower garden, only spread abroad their beauties to the night. Other plants exhibit a certain amount of irritability, or sensitive qualities, under mechanical or chemical stimuli. The *Drosera* and *Dionæa* woo the unwary fly to its destruction shutting it up in deadly folds, while the *Mimosa sensitiva* and a few others will shrink from the most delicate touch, and may be laid asleep, during any severe operation of the gardener, under the influence of opium or Chloroform. If on the other hand we assume as the characteristic of the animal, its capability of changing its position, we still find similar properties in the plant; for vegetable organisms are in some instances capable of changing their position and performing other movements. Thus the Zoospores of Cryptogamic plants are locomotive, and the *Desmodium gyrans* is possessed with a restless activity, its lateral leaflets dancing a perpetual measure to the music of the air. As we compare then these indications of sensibility, and these locomotive powers in the vegetable with the humbler endowments of such an animal as the sponge, which remains through life chained to one little spot of rock, giving out no indications of sensibility, we must at once be struck with the difficulties attending a true distinction, and the intimate relation that exists between the two kingdoms in question. True, we cannot instance the automatic performances of the vegetable as identical with the similar endowments of animal life, but still they indicate a sympathy, a harmony existing between the two organizations, and show us how closely the great principles of animal and vegetable life converge. Indeed, as they approach the common centre, the little cell that is the habitation of both, it is perhaps impossible to say, *here begins animal and there vegetable life.** These, here in their infancy, are subtle essences far beyond our conception, and the naturalist, as he gathers this new world together on the field of his microscope, can only *judge* and *name*, after long and patient study of conformation and habits.

Thus far we have dealt in generalities, let us now therefore exa-

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* This animal and vegetable affinity is very amusingly discussed at p. 448 of the April No, of the Dublin University Magazine 1857.—Ed.

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mine more closely the consanguinity of the two kingdoms, beginning with the birth of the members of both in a simple cell, and then considering what important parts cellular structures play throughout all the economy of their future life. Buffon on beholding the smallest animal of the existence of which we are aware, the little monad that swarms in stagnant water, imagined that all vegetable and animals were built up of these minute cells. True to its unchanging philosophy, which laughs at every new truth, the world sneered at Buffon's improbable idea ; but we know now that the sage naturalist saw truth in his dreams. The smallest of the Infusoria, the most minute Cryptogam are but simple cells living an independent isolated life, and every living structure however complex, however strange, has had a cellular origin, and is indebted for its growth and maintenance to the modification and development of cells.* The cell consists of an enveloping membrane or cell wall, that encloses a peculiar fluid and nucleus or cell-germ. True we find numerous examples of cells that do not exhibit even the trace of a nucleus, but from these it may either have been removed by absorption, or it may be destined to appear at some future era of their existence. The modes of Cytogenesis are various, but nearly all agree in being common to the animal and vegetable. To the older Physiologists the subject of reproduction was fertile in speculation and romance, and it was only when the theory of cells and their development became known, that we were able to read its history in the earlier and more mysterious stages. In the higher animals and plants, the process is complicated in accordance with the general plan of organization, but as we approach the simple infusorial animal or cryptogamic plant, we can with facility explore the plan of nature's grand secret. Here new generations originate in accordance with the laws of Cytogenesis, the nucleus of the parent preparing a future race, or some of the other systems obtaining by which the old cell begets the new.

Remembering then that Cytogenesis is in all cases the necessary part of the process of reproduction, if from the generation of the lower species we proceed upwards to the more perfect animal or plant, we shall find that any complication of plan is merely sup-

* The exceptions to this general rule do not demand special notice.

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plementary for the nurture and development of a superior embryo. It is unnecessary to compare the various structures that are met with in the two kingdoms, as the results of the transformation of cells. In both we find tubular tissues formed by the coalescence of cells, sclerous tissues where the cells have been solidified by internal deposit, and in Ascidian Mollusca a considerable quantity of cellulose, the substance proper of plants. Indeed one observer relates, that cellulose can be detected by chemical reagents in the corpora amylacea of the human brain; and if we can therefore credit Virchow, the appellation " timber headed" will after all have a foundation in truth.

We now come to consider some of the functions of organic life, premising that in all organs where these vital operations are carried on, we find a true cellular structure retained. Beginning with absorption and assimilation, we find these processes varying, according to the rank of the animal or plant, in the respective kingdoms, but still agreeing in the constant cellular agency. Amongst individuals of humble status, the nutritious matter is at once received through the cell wall by the process of endesmose, to be elaborated and applied in the cavity of the cell to the various wants of the structure. This of all methods is the most simple, and a key to the plans of absorption and assimilation in the higher divisions, inasmuch as any apparatus more intricate is merely superadded for the production of a more elaborate nutritious fluid, and its transfer to distant parts of the organism. In the Vertebrata absorption and assimilation obtain in their most perfect state, as we find in this group a distinct tubular system, solely concerned in the manufacture and translation of the chyle or alimentary fluid. Between this and the simple endesmose and assimilation of the animalcule, there are many intervening gradations of process, and as an example of an animal occupying an intermediate position between the two extremes, we shall briefly contemplate the internal economy of an Annelide, the *Hirudo medicinalis*. In this creature, nearly the whole of the visceral cavity is filled by the stomach, which consists of an elongated tube with a number of lateral sacs. Over these cæcal appendages is spread a delicate net-work of the terminal branches of the circulatory system, destined to receive by

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endesmose the elements of nutrition, which thus pass in their crude state into the general circulation, where they are elaborated and fitted for their future destiny. In the vertebrate animal, the lacteals already referred to terminate by looped extremities amongst a number of cells and nuclei; and during the passage of chyme along the intestine these nuclei become developed into cells, and the cells are busy at work selecting, absorbing and elaborating, and then yielding up their contents to the loops of the lacteals. In plants the root is the great organ of absorption, whether suspended in air, floating in water or buried in the earth. The root consists of a cellular epidermis, and internal structure of vascular bundles and cells. Here then cells are still the great organs of absorption, and if we trace the sap upwards through the alburnum and leaves, and its return through the lactiferous vessels and cells of the bark, we shall find them not less active and essential in the process of assimilation. If we now review the function of respiration in the animal and plant, we shall find that although by this process the animal eliminates carbon and consumes oxygen, while the plant fixes the former and gives off the latter, being thus so far opposed in object, they nevertheless agree inasmuch as respiration is carried on in both kingdoms, by means of organs of a cellular structure. In both too the ultimate objects of the function are the alteration and refinement of the circulating or nutritious fluid, the blood in the one and the sap in the other being fitted for the production of new or repair of old tissues, and for keeping up a supply of the various secretions. Respiration is therefore a depuratory process, and perhaps the least vital of any of the functions of organic life, many of the changes it effects being merely the results of a chemical action. We come now to speak of secretion, which is carried on by means of certain cellular organs called glands. These appropriate each a definite nature of material from the circulating fluid, as it passes along fertilized by the results of absorption and assimilation. Besides their nutritious elements however, the blood and sap contain unorganizable substances the effete products of tear and wear, which are separated to be excreted by glands differing in no important particulars from those already mentioned. The individual cells concerned in the manufacture of

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the various secretions, as they disclose no appreciable disparity in structure to account for the dissimilarity of their products, must therefore possess some special endowment or quality, whereby they are enabled to make a selection of material. The mode in which the gland as a whole is constructed can have no direct influence in this respect, for secretions are vicarious, and the same gland assumes different forms in different grades of the animal kingdom. We have not space to compare the secretions of the two kingdoms, and would merely insist on the similarity of secreting structures in both, and the mysterious faculty that these possess of selecting certain substances, and only these during health, from the circulating fluid.

Thus through all the functions of organic life, there exists between the animal and plant a wonderful consanguinity. In both we find a variety of processes instituted with a view to the same results, and performed by means of structures identical in the plan of their conformation. There are still however other relations, equally strange, existing between the two kingdoms; and these are perhaps more directly practical in their bearings than those already noticed. The great Creator of the universe, has established a fixed Geographical distribution of the varieties of the animal and plant, that cannot be departed from without incurring the risk of disease or even death. The Esquimaux enjoys perfect health, living in his snow-hut and feeding upon raw flesh, the supply of which is far from regular or abundant; a mode of life that would, to say the least of it, be dangerous to any native of a temperate climate, and death to any member of an intertropical race. On the same inhospitable shores of the frigid zone, we find a scanty flora of Saxifragaceæ, Salices and Cochleariæ, not one of which has ever been removed to a milder climate with impunity. Still more impossible would it be to transplant and to adorn with our Magnolias, Camellieæ or Palmæ, the ice-bound coasts of Labrador or Greenland; or to exchange for the Lion and Tiger of the one region, the fiercer and more powerful White Bear of the other.

Early in the summer of 1852, a dog and bitch only a few months old were picked up by me on the shores of Melville Bay in about 75° N. Latitude. Both were in good health so long as we remain-

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ed in high latitudes, but on the homeward voyage as we approached the Orkney Islands, in the month of cold November, both animals became sick, suffering from *fits*. The dog died of congestion of the brain, just as we sighted land, and towards the close of the following spring the bitch, which was then in the Highlands of Scotland, died I believe from the same cause. We have little reason to doubt that in both these cases, elevation of temperature was the exciting cause of disease. Of several varieties of hardy garden seeds imported from England in tin cases, and sown in a garden soil of fair quality in Kirkee this season, only a very few specimens have lived to come above ground; and yet the seeds looked fresh and healthy enough. In several colonies to which seeds, such as corn and barley, have been sent from Europe, even these sturdy plants suffered from the change of climate, and it was only after the careful culture of a few years that they began to yield an abundant return. On the other hand the agriculturist knows well the advantage of having seed from a limited distance, where there is not any considerable difference in climate involved in the change. Those at all conversant with a pastoral life also know the change in height and appearance that takes place in the Shetland breed of ponies, when transported young from their native shores to the south of Scotland or to England. Such a change of pasture and climate has also no little influence on the breeds of cattle and sheep.

Indeed it is an article of our medical creed, that local climate, and quality of soil exercise an important influence over animal and vegetable life. Amid the dank exuberant vegetation of the jungle, diseases exhibiting great vascular excitement are but too common; amid the smoke-begrimed, tainted atmosphere of the great city what an enervated sickly debased race grow up, and who that has seen in the same sphere a few plants tortured into existence, can say that they looked healthy? The heather is a sturdier plant than the rose or the shamrock, and in general hill tribes are endowed with a physical energy superior to that of their neighbours of the plains. On a poor miserable soil, with scarce vegetation to cover its nakedness, we shall ever find a wretched and thinly scattered population. Looking backwards to the Geological eras of this venerable earth, we also find most wonderful relations, as to

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rank in their respective kingdoms, existing between the classes of animals and vegetables living at the same time on the stage of the world. Thus during the Palæozoic division of fossiliferous history, amid awful forests, pestiferous jungle, and impenetrable underwood consisting of Monocotyledons, Gymnogens, Acrogens and Thallogens, there lived molluscs and a few reptiles, while the waters of the same period were occupied by corals and crustaceans, all animals of low type. Advancing to the next or middle great division, we find specimens of the classes enumerated as characteristic of the previous period, only modified in accordance with other features of that creation. In addition to these however, we have gigantic reptiles and birds, a few mammals and some dicotyledonous plants. Then comes the tertiary period, when the dicotyledon is king of the forest, when mammals of immense proportions are predominant, and reptiles are dwarfed into something like their present size. Thus throughout the two kingdoms we have a contemporaneous progression from the lower to the higher forms, as the earth is changed from an impracticable to the present world with all its beauteous creations, of which man is lord. We find no traces of his footsteps however, in the Palæozoic or any other formation, until the earth has been made a fit and pleasant habitation for him and his seed for ever. Neither have we a plant of the higher orders, living together with animals or vegetable forms of low caste, during an early fossiliferous era. The sun did not then shine with his present benignity, not a bird looked down on its shadow in those dreary waters teeming with monsters, never did its notes sing of verdant plains, of pleasant groves, of fertile valley and bounteous river, but the discordant cries of fearful forms, the weak in their death agony, the strong rejoicing in their might, startled the echoes amid forests of fabulous extent and trees of eccentric appearance. In each and all of these periods of Geological history, we find certain classes of animals co-existing with consonant grades of vegetable productions. We find not a single departure from this rule, for throughout all the works of the great Creator there is a constant harmony.

> "In reason's ear they all rejoice
> And utter forth a glorious voice,
> . . . .
> The hand that made us is divine!"

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VIII. *Suggestions for a uniform System of Weights and Measures throughout India. By* W. H. BAYLEY, ESQ., *of the Madras Civil Service.*

The expediency of defining, by authority of Government, some standard of Weight and Measure, applicable to the whole of our Indian territories, is generally admitted; but what that standard should be, what its multiples, and how it is to be effectually introduced among the people, are questions on which opinions greatly differ.

No system can be specified which will not be open to *some* objection, and the object of this paper is simply to propose for the consideration of those interested in the matter, a few different modes of arranging the Weights and Measures, in order that the subject may be well discussed by those qualified to give an opinion, before any one system is authoritatively adopted.

With the exception of the weight of the Rupee, (180 grains), there exists no defined standard of Weight or Measure in India. There are certain traditionary standards, but these differ all over the country, and in practice are not adhered to, nor is there any Law on the subject, by which the gross irregularities that prevail can be checked.

In the adoption of a new and uniform system, it appears necessary either to determine on one that bears a close relation to the most prevalent of the existing Indian systems, or else to adopt one that will accord with the Imperial Weights and Measures of England. The former would be the most acceptable to the Native population, and therefore more easily introduced: the other would best suit the requirements of the increasing trade, and political connection, with Great Britain.

The subject has to be considered under four heads. I. Weight. II. Measure of *Length.* III. *Superficial* measure. IV. Measure of *Capacity.* The second and third points will be first alluded to, be-

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cause, as regards those two, there seems less difficulty in coming to a conclusion as to the most applicable and feasible arrangement.

The unit of *Linear* measure in India, is generally the distance from the elbow to the tip of the middle finger of a tall man, and is of course no standard at all. This length is known as the *hat'h* or *moolum*, and averages 19½ inches. It is always translated *cubit*, though invariably exceeding the English cubit of 18 inches, by 1½ or 2 inches. In the Southern Carnatic, the *adee*, or length of a tall man's foot, is in use, and averages 10¼ inches. The *Guz* (translated *yard*) is partially in use all over India, but varies in different localities from 26 to 36 inches. In Bombay it is 27 inches, and in the North-West Provinces of India it has been defined by the Government, for the purpose of Survey, at 33 inches.

Although the above are the *Indian* linear measures, the English yard and foot are very extensively adopted by Native artizans; and in all the Public Works of India, which give employment to thousands of Natives, the English linear measure is universally employed. Considering therefore that this Measure is already so familiar to the people, and that their own is so undefined, and fluctuating in practice, there can be little doubt but that the English Yard and Foot should be determined on for the new Metrical system.

It might not be advisable to define the *subdivisions* of the Yard and Foot, till the question is settled in England. Both Parliamentary Committees that have reported on the subject of Weights and Measures, in 1841 and 1854, have recommended a *decimal* subdivision, and it has been adopted already as regards the *foot*, by English architects and surveyors.

The next point is *Superficial* measure; and this need only be noticed in connection with *Land-measure.* According to the ancient Indian system, an area of land is often named after the quantity of seed required to sow it, or the quantity it will produce, and of course the actual area differs according to the opinion of the person who makes the estimate. Where linear definition *is* given, mention is made of Rods or Ropes, of so many cubits, but

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the cubit is undefined, and areas of the *same denomination*, are derived from different multiples of Rod or Rope. Of the more definite terms, the *Beega* prevails in Bengal and the North-West Provinces. In Bengal it is 1,600 square yards, and in the North-West Provinces it is 3,025 square yards. In the Bombay Presidency it is not authoritatively defined, but averages about $\frac{3}{5}$ of an acre. The term is quite unknown in the Madras Presidency, where the authorised measure is the *Cawnie* of 57,600 square feet, or 1·3223 acre; there are also other local land measures, defined, but presenting great differences one from the other; as the *chain* of 3·64 acres, the *seed-cottah* of 1·62 acres, the *vaylie* of 6·6 acres, and the *bullah* of 3·82 acres.

The greater portion of the North-West Provinces of India has been surveyed by Government Officers. The area of each village (or rather parish, to use an English term) is given in Imperial acres, but the areas of the *fields* appertaining to each village, are given in local *beegas*. The introduction of the acre therefore was only partial. In the Surveys lately made in the Bombay Presidency, the area of each field is recorded in acres, not only in the English, but in the vernacular accounts, and the term is well known and understood among the people. In the Madras Presidency, the districts of Bellary and Cuddapah were measured field by field (as far as the land was cultivable) in acres, in 1803, and Kurnool in the same way in 1842. In Salem, the records of field measurements made about 1800, are entered both in the Native terms and their equivalents in acres, and the acre is by far the best known.

Under the above circumstances, the introduction of the Imperial acre seems not only most desirable, but quite feasible. Where lands have already been *accurately* measured, and contents recorded in Native terms, those terms might be converted into acres; and in the progress of the Surveys now going on, all measurements might be at once in acres. This plan has already been successfully adopted in the present re-survey of the Southern districts of Madras, and the acre is superseding the *cawnie*.

With regard to the *subdivisions* of the acre they have hitherto in the Madras Presidency been in 40ths (or Goontas), and

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and 16ths of 40ths; or else in 16ths (annas) and 4ths of 16ths. A decimal subdivision is most desirable; not only is the computation far easier to the surveyors, but records in decimals, are far more intelligible than in Roods and Perches, and money values in relation to areas more easily calculated. The areas recorded in the Ordnance Survey of Great Britain, in which Survey every field is measured, are now in acres, *and decimals* to the third place. There cannot be a better authority for a decimal subdivision, and it offers no difficulty to the Natives, as regards *land* measurement.* The cawnie, itself, is in several districts in the Madras Presidency, subdivided into 100ths, and in the present re-survey of the Southern Districts of Madras, the decimal subdivision of the acre has been authorised, as stated in para. 11.

The next subject to be considered is that of Weight; and this is important, inasmuch as the best method of fixing a standard for measures of *Capacity*, is with reference to the *weight* of water they will contain.

The difficulty connected with determining a standard of *Weight* for the whole of India, is increased by the fact that there are conflicting interests and opinions on the subject. Some of the best authorities urge that the Ponderary system of India, already in some degree established, should be founded on the Rupee (the tola of 180 grains), as the standard coin of the country, always accessible in cases of doubt or suspicion. Others there are, who perceive in the increasing trade with Great Britain, the great want of some system by which the Weights and Measures of both countries may be assimilated, and they object to the tola unit, because no number of even tolas will correspond with one, two, three, four, five, six, seven, eight, or ten *pounds* avoirdupois, the nearest ratio being 350 tolas=9lb.; a most inconvenient proportion.

* It is hardly necessary to argue why a decimal subdivision of *Land* Measure, should be easier of introduction than a decimal arrangement of Weights and Measures in general. It is, in practice, a mere division of account. In England not one person in a thousand is the least put out by the substitution of Decimals for Roods and Perches: whereas, not one in a thousand but would be inconvenienced (for a time) by the substitution of 10th of Gallons for Pints, or by Ounces of ten to the Pound.

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An arrangement on the *Tola unit* will first be considered.

Though the larger Weights throughout India are utterly devoid (in practice) of rule or uniformity, being generally misshapen lumps of metal, or stones, and varying in value as well as denomination in every district almost,* there has from time immemorial been a small weight called a *tola*, in use by Goldsmiths and Jewellers, which has maintained a ponderary value of about 182 or 184 grains. When the Government of India, by Act VII. of 1833, (the main purport of which was to fix the weight of the Furruckabad rupee at 180 grains)† decided on 180 grains as the *tola*, they in the same Act declared that this tola should be "the unit of a "general system of *Weights* in all *Government transactions.*"

The "Table" of Weights adopted by the Government of India for the use of their own offices, is in accordance with Native usage in Bengal, and was approved of by the Chambers of Commerce in Calcutta and Bombay. It is as follows:

1 Tola	=	180	Grains.
5 Tolas	=	1	Chittak.
16 Chittaks	=	1	Seer = 80 Tolas = 2·057143 lbs. avoir.
40 Seers	=	1	Mun = (or maund) = 82$\frac{2}{7}$lbs. exactly.

* The traditionary and acknowledged unit of Weight is generally the RUPEE; thus the "Seer" is said to be so many Rupees weight; but it is very seldom possible to say what was the weight of the Rupee forming the original unit. The Rupees of the different Native Governments varied considerably, and even under the British rule the Sicca Rupee of Bengal was 192 grains, when the Arcot Rupee of Madras was 176½. These differences in the small unit would effect the larger ones considerably, and aggravate the uncertainty as to what was their original and real value. Besides this, terms of the same denomination do not by any means denote the same value. A Candy, (Khundee) for instance, in one place differs very much from the Candy of another place. Again, a Candy (for instance) of Metal, is not the same as a Candy of Tobacco; and there is a different Candy for Cotton and Sugar. The Candy used in buying, is not always the same in the same place, as the Candy used in selling.

† The Furruckabad rupee used in the N. W. Provinces, had hitherto been 180·234 grains. The Rupee of Madras and Bombay had been for some years 180 grains. The "Sicca" Rupee of Bengal still remained at 192 grains, but this coinage was discontinued in consequence of Act XVII. of 1835, and since that date the Company's Rupee of 180 grains has been the only Rupee coined at any of the Government Mints.

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If any system of Weights is to be selected from those now current in any part of India, the above seems to be the best, not only because it is founded on a defined standard, originating in the weight of the coin of the realm, but because it includes the "Seer" of 80 tolas, which is a weight known and acknowledged in *some* degree all over India. It is in short a Ponderary system which as far as *facility of introduction* is concerned, has a preference over any other.

It may however be well here to notice a remark that is sometimes made with reference to the Legislative Enactment above referred to, and the Official "Table" of Weights; and this is, that it is needless to discuss any new scheme for a Metrical System, inasmuch as the law has been already declared on the subject, and the system actually in force; all that is required being an endeavour to extend its use where prejudice has already prevailed against it.

In reply to this it may be observed, first, that the Enactment refers only to *Weights;* and secondly, that it only effects *Government transactions.* Surely that cannot be called a Metrical system which merely defines the Weights that the Government prefer for their own use, and which leaves untouched the subject of *Measures*, a point (in India especially) quite as important, and much more difficult to arrange than that of Weight. Neither can it be said that a system is in force, which is a mere guide for the terms of account in Official papers, and by no means obligatory on the people. I can confidently assert that, as regards the 140,000 square miles comprised in the Madras Presidency, not a single bazar-man has altered his Weights one grain, or his Measures one fraction of a cubic inch in consequence of the Calcutta notification. Neither was the Act intended to go farther than legalise the tola as a *unit.* The "Table of Weights" has never been adopted in the Madras Presidency, even in *Government transactions.* In the Fort St. George Gazette of the 20th October, 1846, the following Table of Weights was published as that which was to be used in that Presidency:

180 Grains	=	1 Tola.
3 Tolas	=	1 Pollum.

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40 Pollums	=	1 Viss	=	120 Tolas	=	3·0857lbs. avoir.
3 Viss	=	1 Maund	=	960 Tolas	=	24·6857lbs. avoir.

This "Table" was sanctioned for Madras by the Government of India, and is, as will be seen on comparison, entirely different, with the exception of the tola unit, from the Weights adopted for Calcutta.

The above remarks are made with the view of dissipating the illusion that a Metrical system has already been defined by law, and is actually in use to a considerable extent. The universal introduction therefore of the Calcutta Table, although easier than that of any other, would still not be quite so simple a matter as some persons have been led to expect. In the Madras Presidency it certainly would be difficult to get rid of the present Native systems of Weights, which in general correspond with the Table promulgated by the Government of that Presidency.

It will be observed that the Madras Government Table does not acknowledge the "seer" weight at all; but still a seer weight of 80 tolas, known as the "pucka" seer is met with all over India. It is not much in use in Southern India, where the "seer" of 24 tolas, called the "cutcha" seer, is more common.* There are also "seers," both in Madras and Bombay, of 84 Rupees weight. Still, a seer of 80 tolas could no doubt be more easily introduced throughout India than any other weight.

The Calcutta Official "mun" or maund, is 82$\frac{2}{7}$lbs. avoir., and is not known in any part of the Madras Presidency, except at the Government Salt Depôts, and in the Coast trade of grain to the port of Madras. The Madras maund is 25lbs; the Bombay maund is 28lbs.; and the Surat maund in use on the Western Coast is 31$\frac{1}{3}$lbs.

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* The original unit of WEIGHT in Southern India, seems to have been the gold coin called by the English, a "pagoda." It is now uncurrent, but was about 52½ grains weight. 80 pagodas weight is, according to the Native Tables, a "seer" (cutcha) of 24 RUPEES weight. This corresponded with the average weight of the old Native rupees of 175 grains; but since the introduction of the "Company's rupee" of 180 grains, the "pagoda weight" is 54 grains generally. The same confusion formerly existed in Bengal, between a Sicca WEIGHT of 179$\frac{2}{3}$ grains, and a Sicca RUPEE of 192 grains.

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The chief objection to the Ponderary system enunciated by the Government of India, is that it cannot be made to accommodate itself to the Imperial Weights of Great Britain, and this, considering the importance of the trade between the two Countries, and the fact that one is a Dependency on the other, is a serious drawback.

The following Table shows the nearest proportions that can be obtained, for converting the above system of Weights, to those of Great Britain (avoirdupois).

38·889	Tolas	=	1lb.
350	Tolas	=	9lbs. *exactly.*
1	Seer	=	2·057143lbs.
35	Seers	=	72lbs *exactly.*
1	Mun	=	82$\frac{2}{7}$lbs. *exactly:* or (82·2857143. . .)
7	Muns	=	576lbs. *exactly.*
49	Muns	=	36 cwt. (of 112lbs.) *exactly.*
27·216	Muns	=	1 ton (of 2240lbs.)
490	Muns	=	18 tons *exactly.*
300	Muns	=	11 tons (strictly 11·0204.)

It will be seen that under such a system, there will always be difficulty and confusion in adjusting the weights of articles of commerce to the English Table, and as the connection between the two countries increases, and the European element becomes more marked, the inconvenience will be more practically felt.

Much stress has been laid upon the advantage of the 'Seer' and 'Mun' of the above Table, in consequence of the "Seer" being exactly equivalent to 2½lbs. Troy, and the "Mun" exactly 100lbs. Troy. There is no doubt some convenience in this to the *Mint*, but except as regards Bullion, and Medical prescriptions, *Troy* weight is practically unknown. The Parliamentary Committee in their Report on the 'Restoration of Standards' in 1841, condemn it as "useless;" and the Committee in their Report of 1854 on the 'Construction of the Standards,' state that "there is now a prospect of "attaining the long desired simplification of the British system of "Weights, by the entire suppression of Troy weight." To defend the Seer of 80 tolas and the Mun of 40 seers, because they correspond with *Troy* weight, may therefore be considered useless.

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Mr. Prinsep, in his "Useful Tables" gives a list of some 300 Rupees of Native Mints, mostly of dates prior to any regular coinage of the Indian Government. They average about 175 grains; and had the Government adopted 175 grains instead of 180 for the rupee, a "Seer" of 80 rupees would have been exactly 2lbs. *avoirdupois;* and a "Mun" of 40 seers, exactly 80lbs. *avoirdupois*, and 25 Muns exactly 2,000lbs., or the proposed new *Ton* for Great Britain. The rupee of 180 grains is *now* so well established in all the Presidencies, and there is such an enormous silver circulation in India, that it seems impracticable to reduce the Rupee to 175 grains; and if the same content of pure silver were retained, (which would be necessary for the credit of the State) the "touch" would be raised from $\frac{11}{12}$ or ·91666, to ·942, which may be deemed too high for durability. The touch of silver in France (where, as in India, it is the legal standard of value) is ·900. In England it is ·925.

Another objection may be made to the above Ponderary system, namely, that the multiples are not *decimal*; but the main advantage of this system, is the comparative facility with which it might be introduced, and this advantage would be lost if the usual multiples were departed from. The only improvement that might be effected without materially interfering with the reception of the system, would be to subdivide the "seer" into 80ths, or single rupees, instead of into 16ths, or chittacks. The division by 80 would be simpler than by 16; the commercial minimum weight of account would be 180 grains, instead of 900 as at present, and the "quarter chittacks" would be unnecessary. The lowest denomination of Avoirdupois weight in England, is the "dram," or 27·344 grains; but this the Parliamentary Committee of 1841 state "does not appear to be used at all." The $\frac{1}{4}$ ounce, or 109$\frac{3}{8}$ grains, is the lowest weight in general use.

The next plan for a system of Weights, that may be noticed, is that in which the "tola" of 180 grains, (being the weight of the Rupee) is the unit, and its multiples Weights of 10, 100, and 1000 tolas. It is hardly necessary to urge that such a decimal arrangement, however desirable for its intrinsic merit, would be unacceptable both to the Native and the European community.

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It would not coincide (except as regards the single tola) with any one of the Native Weights in India, and this with the attempt to introduce at the same time a novel system of notation, would be fatal. The mercantile community, and those who are desirous to see the Indian and English Weights assimilate to some degree, would of course not be satisfied with such a scale.

Another proposition is to adopt the English Imperial Weights at once. The great objection to this would be the difficulty of introducing all over India, a Weight so new to the people as *a pound*. It would represent neither a "seer," (pucka or cutcha) a "pollum," a "chittack," or a "viss," or any definite proportions of them. Again, the question of multiples and sub-multiples is not settled yet in England, and till this is decided, it would be unwise either to endeavour to enforce in India the present English notation, which will probably be altered ere long, or to anticipate a *decimal* arrangement, and introduce multiples which may not eventually be adopted in Great Britain.

There is however a Ponderary system, which I venture to propose, as uniting the advantages of assimilation with the coin of the country,—assimilation (within close limits) with the best known of the existing Native Weights,—and assimilation with the Imperial Weights of Great Britain.

I would propose a "seer" of 77¾ tolas, instead of 80. As far as the facility for testing doubtful weights by the coin of the country, this would answer as well as 80 tolas, for a quarter rupee is just as much a coin of defined weight (45 grains,) as a whole rupee, and where one can be obtained, the other can.

This "seer" would differ 2¼ tolas weight from the one adopted for Government transactions in Calcutta, but practically the "seer" Weights in India, even though professing to be 80 tolas weight, are seldom so much. The seer is generally said to be so many *rupees* weight, and as the rupees of former days, on which these seers were founded, averaged about 175 grains, (see para. 28) the *original* weight would be more nearly obtained by a "seer" of 77¾ tolas. Besides, the 80 tola "seer" is not universal; it has

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already been stated that the "seer" weight varies in different localities, and to substitute a 77¾ tola weight in these localities, would not be more of an innovation, than substituting a "seer" of *eighty* tolas.

The "seer" of 77¾ tolas would be only 5 grains short of a *double pound*, or two pounds avoirdupois; that is, it would be 13995 grains, instead of 14000; which would only make a difference of 1·42lbs in the proposed new *Ton* of 2000lbs, a difference within the limits of error in weighing. It would be advisable perhaps, to *define* the "seer" legally, as equivalent to two avoirdupois pounds; and it might at the same time be declared that a seer of 77¾ tolas weight would not be condemned as short. It is undoubtedly an advantage to have Weights which correspond with the coins of the realm, but it never could be intended, that testing by coins *in use*, should supersede testing by certified standards. The assimilation to coin weight is desirable as a means of readily checking irregularities, but in practice no one would be able by coins, even if new, to state for certain whether a weight was 80 tolas, within 5 grains.* The advantage therefore of a coinage equivalent would remain, if the "seer" weight were defined as *two pounds* English.

The only weak point in the adoption of this "seer," is that its sub-multiples could not be so simply arranged as those of the 80 tola seer, which can so easily be resolved into 80 single tolas. The 77¾ tolas could not be subdivided into single tolas, or even into the favourite Native subdivision of 16ths, so as to give an even number of tolas; but this defect (and all systems that can be proposed will have *some*) is more than counterbalanced by other advantages.

I would propose that this "seer" be subdivided into 16ths, as the present seer is. A division by 16 would be much more acceptable to the native community than a decimal one, and all clerks

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* The difference between 77¾ tolas, and 2lbs., is only equivalent to 1-16th of a grain in the rupee, an amount certainly too small to be taken into account when testing weights by coin in circulation.

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and accountants in India can divide by 16 as readily as Englishmen by 12. There are also 16 Annas to the Rupee, which makes the number convenient. With regard to the *sub*-multiples of the "seer," a coincidence with the smaller English Weights, is not of much consequence in commerce. As regards the *multiples*, I would propose a "Mun" or maund Weight of 50 "seers," which would be exactly the cwt. of 100lbs., which will no doubt, be soon established in England, whatever may be the other decimal multiples and sub-multiples.*

The next point to be considered, is a standard for the Measure of CAPACITY. It will be observed from what has been stated in paras. 16 and 17, that the Government of India has neither in Act VII. of 1833, nor in the "Table" set forth by them, made any allusion to *Measure of Capacity*, although it is a matter of more importance than the Weights, seeing that by far the greater portion of the domestic transactions in India are in *grain*. The Calcutta Chamber of Commerce, when on the 19th of May, 1836, they resolved to adopt the *Weights* of the Government, urged the introduction of the Imperial gallon for *Liquids*, and proposed that new Measures of capacity for grain, should be regulated by the Weights, but they did not show how this was to be done: nor does it seem at all necessary to make a distinction between "Dry" and "Liquid" Measures. The Government declined to act on the recommendation of the Chamber, and whatever might have been contemplated by Act VII. of 1833, nothing has ever been announced by way of defining the capacities of the Grain Measures in Bengal. The only Measures made up (at the Mint) by authority of the Government, are the Imperial gallon and its sub-multiples, for use in the Medical and Victualling departments; and it seems that the Court of Directors in their Despatch of 17th July, 1833, expected the "gene-

* It is stated in the Report, dated 1854, of the Commissioners appointed to superintend the construction of the new Standards, 'Referring to chapters [named] "of the Report of 1841, and the recommendations based thereon, tending to diminish the confusion between Avoirdupois weight and Troy weight, and to banish the Stone of 14lbs, and the Hundred weight of 112lbs, we have to report "that we adopt in their utmost extent the whole of those recommendations.' The Committee of 1841 recommended a "centner" of 100lbs., and a "stone" of 10lbs.

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ral adoption in India" of the Imperial Measures. The *Madras* Government however in their Notification referred to in para. 20, promulgated a Table of Measures to be used in Government transactions, as follows:

1 Olluck	=	12½ cubic inches.		
8 Ollucks	=	1	Measure (Puddee)	= 100 cubic inches.
8 Measures	=	1	Marcal	= 800 cubic inches.

And this arrangement was sanctioned by the Supreme Government for the Madras Presidency. Though 10 years have elapsed, these Measures have not been adopted by the people; and even in the Town of Madras, the Government have authorised the stamping with the Government Seal, the "customary" Measure or "Puddee" of 104¼ cubic inches, which has been the *real* standard since 1802.

In Bombay, the Government have attempted to introduce a "Seer-measure" of the capacity of 57 cubic inches, but this being so much smaller than the usual "Seer-measure" of that Presidency, the scheme has not met with success.

Mr. James Prinsep in his "Useful Tables" observes that "India does not, properly speaking, possess Dry or Liquid Mea-" sures. Where these are employed, they depend upon, and in "fact represent, the "seer" or "maund" *weight.*" This is true of India generally, but in the neighbourhood of Madras, as already shown, and in some of the Southern Districts, the ordinary grain Measure is a "puddee," which does not represent any weight;" and the "puddee" varies greatly in different localities.

The most common grain Measure, and one which is to *some* extent known in almost every part of India, is the "seer-measure;" this is always understood to be a Measure which *when heaped* will contain a "seer" *weight* of rice, or in some places instead of rice, a mixture of the 9 most common grains, known as the *nou-danium* measurement.*

As only *heaped* measure is recognised by Native usage, it is evi-

* The 9 grains used in the Madras Presidency, are Rice, Chenna, Cooltee Pessoloo, Minamaloo, Dholl, Anamaloo, Gingely oil-seed, and Wheat.

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dent that there is no rule as to the *cubic content* of the Measures used; for vessels of very different cubic content may contain the same when heaped, in consequence of having different diameters. It is on this account that the values given to Indian Measures, in such Tables as those of Major Jervis, or Dr. Kelly (in his Cambist) being founded on the guaged cubic contents, do not represent the true quantities.

In 1852, the Madras Board of Revenue instituted a special enquiry into the Grain Measures of each district. They were found to be of all shapes and materials. Some were in the form of hour glasses; some were joints of bamboo; and some earthenware pots; but as a general rule, it was found that they were in most districts intended when *heaped*, to contain a seer weight, or a definite number of seers, either of rice, or of mixed grain, but usually rice: and the "seer" weight was generally that of 80 tolas. Measures in every district were guaged with Water, Rice, and Cooltee or Horse gram, and it was found that (taking 100 cubic inches of water to weigh 140 tolas, which at a temperature of 81° is true to ½ a grain) Rice on an average, weighed 113 tolas to the 100 cubic inches.* From experiments made by myself a few years ago, I found 100 cubic inches, of the 9 mixed grains, to weigh 115 tolas. From the Reports of Mr. Shaw, of Ahmedabad, in the Bombay Presidency, in 1849, it appears that he found that a Measure holding 137¼ tolas of water, held when struck 114⅗ tolas of mixed grain, which gives 116½ to 100 cubic inches; and Mr. Reeves, of Poona, found that a vessel containing 80 tolas weight of water, would hold 66¾ tolas of mixed grain, which also gives 116½ tolas to 100 cubic inches. Cooltee, or Horse gram, was found by the Madras experiments to average 116 tolas to 100 cubic inches, but it varied from 113 to 118. From the same experiments, the weights of the *heaps* (of rice) on various diameters were determin-

* In the Northern Districts, it averaged 111 Tolas; in the Town of Madras 114 and in the other Districts 112 and 113. The rice used was what is called in Madras, "Putcharisee," or RAW RICE, to distinguish it from "Poolungul," or that which is scalded before husking. Old rice would weigh something lighter.

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ed, as shown in the margin; but it is probable that the dealers in the bazaar, would not heap quite so liberally. The accuracy is of course not so great but that the diameter may be considered either the inner or outer.

The best "Seer-measures" are about $3\frac{1}{2}$ to $3\frac{3}{4}$ inches in diameter, and 6 inches deep, but they are never true cylinders. Their cubic contents are from 66 to $66\frac{1}{2}$ cubic inches, holding from 74 to 75 tolas of rice when *struck*, and 80 when heaped. It so happens, as may be seen by reference to the Appendix,* that a vessel of $66\frac{1}{10}$ cubic inches capacity will contain at a temperature of 84° (a good *day* temperature for India,) 16650 grains, or *exactly* $92\frac{1}{2}$ tolas weight of water. This would hold on an average when *struck*, $74\frac{1}{2}$ tolas weight of rice; and with a diameter of 3·7 inches, 80 tolas if *heaped*. Thus if a "seer" of 80 tolas be adopted, such a Measure would be exactly what is understood by the Natives of the country to be a "Seer-measure."

Diameter Inches.	Tolas wt. of Rice in heap.
2	2
$2\frac{1}{4}$	$2\frac{1}{2}$
$2\frac{1}{2}$	3
$2\frac{3}{4}$	$3\frac{1}{2}$
3	4
$3\frac{1}{4}$	$4\frac{1}{2}$
$3\frac{1}{2}$	5
$3\frac{3}{4}$	6
4	7
$4\frac{1}{4}$	9
$4\frac{1}{2}$	11
$4\frac{3}{4}$	13
5	15
$5\frac{1}{4}$	18
$5\frac{1}{2}$	21
$5\frac{3}{4}$	24
6	27
$6\frac{1}{4}$	30
$6\frac{1}{2}$	34
$6\frac{3}{4}$	38
7	41
$7\frac{1}{4}$	45
$7\frac{1}{2}$	49
$7\frac{3}{4}$	53
8	58
$8\frac{1}{4}$	63
$8\frac{1}{2}$	68
$8\frac{3}{4}$	74
9	80
$9\frac{1}{2}$	92
10	104

No measure of capacity could be more easily introduced than this, and a Table † might be framed, according to which the multiples of the Seer should bear a correct proportion when *struck*, and also as correct a ratio when *heaped*, as the circumstances of the case will admit; at all events nearer than has hitherto satisfied Native usage.

The sub-multiples of the "Seer-measure" are generally (not always) used for *Liquid* measures in India. The only liquids sold by measure, are Ghee, (clarified butter,) Oil, and Milk. No defined measure is used for Arrack and Toddy (intoxicating liquors), and

* Vide page 212.

† Vide page 198.

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Spirits in Madras are sold by the "dram" of 5·775 cubic inches, or $\frac{1}{40}$th of the old Wine gallon.

Instead of making 40 "seer-measures" = 1 "Mun-measure," which might cause a confusion in the terms of Weight and Measure, (and the term Mun or Maund is not in use as a grain measure in Southern India,) it would be better to give some name to a quantity represented by 100 Seers. This might be called a "Sotee," from *so*, a hundred. The "Table" adverted to in the preceding page, would be as follows :

DRY AND LIQUID MEASURES.

Seers.	Cubic inches.	Tolas of Water.	Tolas of Rice when struck.	Tolas of Rice in heap.	Total weight.	Diameter inches.	Depth inches.
I.	61·1	92½	74½	5½	80	3·7	6·2
II.	123·2	185	149	11	160	4·5	7·7
III.	198·3	277½	223½	16½	240	5·3	9.0
IV.	264·4	370	298	22	320	5·7	10·3
V.	330·5	462½	372½	27½	400	6·2	10·9
VIII.	528·8	740	596	44	640	7·3	12·8
X.	661·0	925	745	55	800	7·7	13·0
LIQUID MEASURE.							
½	33.0	46¼				3.0	4·7
¼	16·5	23⅛				2·5	3·4
⅛	8·25	11$\frac{9}{16}$				2·0	2·6

Although the above plan for Measures of *Capacity* would probably have the great advantage of facility of introduction, yet it is objectionable for any Government to lend a sanction to *heaped* measure ; moreover it will be observed that such a system does not accommodate itself at all to any English Measure of Capacity. Lastly, it would be *indispensable* that in every Measure used, the exact diameter be retained, in order to secure correctness (as far as it can be secured) in the heaped measure. This would give rise to a great deal of inconvenience, and is not a necessary element where *struck* Measures only are acknowledged.

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I would propose as a Measure of *Capacity*, a vessel to be called a "Seer," but exactly equivalent to an Imperial Quart. The present "seer-measure" averages a capacity of 66½ cubic inches: the Quart is 69·3185. The present "seer-measure" contains when *struck*, about 74 tolas of rice, or 76 of mixed grain, and about 80 tolas of either when heaped: the Quart would contain 78 tolas of Rice, or 80 of mixed grain when *struck*, and (with a diameter of 4 inches,) about 86 tolas when heaped; but heaped measure should not be recognised by Government. I cannot but think that if there exists an English Measure which corresponds (taking *struck* content) so closely either to the Native "seer" of 80 tolas, or to the "seer" of 77¾ tolas which I have proposed, that it should be adopted, whichever of the two "seers" of *weight* the Government may select. It is also to be added, that the Quart will contain an even number of tolas (rupees) weight in water; namely, 17460 grains, or 97 tolas *exactly*, at a temperature of 84° Fahrenheit. This may be calculated from the Table at page 212.

The "Seer-measure" then, would be defined as a vessel containing 97 tolas of water at a temperature of 84°, and its bulk 69·3185 cubic inches. A reference to the water being *distilled*, or to the height of the Barometer, will not be necessay in practice. The Barometer in the Tropics fluctuates very slightly, and a fall of 1 inch, due to an elevation of about 940 feet, would only make a difference of ·615 grain, to be deducted from the normal 97 tolas assigned to the Quart-seer.

It would not be necessary, if the Government recognised *struck* measure only, to define the diameters (or even the shapes) of the vessels of capacity, for all that is required is that they contain a certain number of tolas weight of water. Still for uniformity's sake, and the more easy discovery of fraud, the vessels should be cylindrical, and it would be desirable that the models, as well as all vessels made up at the Government Stores, should have a diameter proportionate in some simple ratio, to the depth. The diameter the same as the depth would be the best, but those who are accustomed to measuring grain and salt, assert that this would be too broad to be convenient, and a diameter one half the depth too

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narrow. A good proportion is that of 3 to 4, and the contents of a cylinder being given, it is easy to compute the requisite diameter and depth.

Let s=cubic contents given.
d=diameter to be found.
h=depth to be found.
3:4=diameter to depth.

Then [I] $d = \sqrt[3]{\frac{s}{\cdot7854 \times \frac{4}{3}}} = \sqrt[3]{\frac{s}{1\cdot0472}}$

And [II] $h = \frac{s}{d^2 \times \cdot7854}$

From these Formulæ, we obtain the following Table for both *Dry* and *Liquid* Measure.

Quarts.	Tolas water. at 84°	Cubic inches.	Diameter in inches.	Depth in inches.	Tolas Rice. 113 tolas to 100 cub. in.
I.	97	69·3185	4·04	5·39	78·3
II.	194	138·6370	5·10	6·80	156·6
III.	291	207·9555	5·83	7·80	234·9
IV.	388	277·2740	6·42	8·57	313·2
V.	485	346·5925	6·92	9·28	391·5
VIII.	776	554·5480	8·09	10·79	626·4
X.	970	693·1850	8·71	11·62	783·0
½	48 ½	34·66	3.18	·425	39·2
¼	24 ¼	17·33	2.55	3·40	19·6
⅛	12 ⅛	86·65	2·00	2·68	9·8

If the "Seer" Weight of 77¾ Tolas=2lbs Avoirdupois, be adopted, the "Seer-measure" will, if the vessel be struck, correspond sufficiently; for the weight of rice varies from 112 to 114 tolas to 100 cubic inches; and if the 9 grain standard is taken, the above "Seer-measure" will contain just 80 tolas, (at 116 tolas to 100 cubic inches) and be when *struck*, the exact equivalent of what is now the average "Seer-measure" when *heaped*. This of course will render its introduction much easier than any other struck Measure that can be adopted.

Even in Madras, where the "Seer-measure" is not recognised

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in the Government Notification, such a Measure averaging 80 tolas weight of Rice when *heaped,* is in use in many of the Districts, and the Sepoys of the Native army always buy by the Seer, generally considering it to be ⅔ of the Madras "Customary" Measure of 104¼ cubic inches, which would give 69⅓ cubic inches, or an Imperial Quart. On the 17th July, 1855, the Madras Government, in consequence of some dispute on the subject, decided that the Sepoys' "seer-measure" should be 5½ of the "Ollucks" named in their proclamation of 1836, or 68¾ cubic inches. This closely corresponds with the Quart of 69⅓ cubic inches, which I propose as the standard "Seer-measure."

The only multiple of the "Seer-measure" that seems necessary for Accounts, is one of 100 seers, which might, as proposed in another place* be called a "Sotee." For *sub*-multiples I would propose *eighths* (âtees) as more in accordance with Native usage. It is seldom that a less measure appears in Commercial accounts than single seers, and therefore there is not so much object in a Decimal *sub*-division.

The objection to the "Seer" proposed by the Bombay Government, which is a vessel holding a Seer of 80 tolas weight of water, or a capacity of 57 cubic inches, is that it is a *misnomer.* If the Native term "Seer" is to be used at all, it should be the Native idea of a Seer, that is, a vessel containing a seer weight of *grain.* The new Seer for grain is not what it is supposed to be, and it is no wonder that success has not attended the attempt to introduce what the people consider a deception. A little difference *above* the usual "Seer," would not have been of so much consequence, but this proposed Seer only holds 70 tolas of mixed grain, even when *heaped.* If it were desired to have a Measure analagous to a Seer, to contain a definite number of tolas weight of water, it surely would have been better to have guaged the Bazaar Seers with water,† and have taken the average weight in tolas, about 93, and fixed on that for the standard Seer-measure ; but if the "Seer-measure" is *not* to accord at all with the Native Measure,

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* Vide page 198.

† The Bombay Government in their Proceedings of the 30th July, 1849, proposed this, but it does not seem to have been acted on.

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it would be just as easy, and far better on other grounds, to introduce an English Measure of Capacity at once.

With reference to the selection I have made of the Quart-seer, (in consequence of its closely representing the Native "Seer-measure," and also the two pound "Seer-weight,") it may be said that in the reform likely to be made in the English Measures, the Quart will disappear, as not being a decimal part of a Gallon; but at all events the measure will be a *quarter* of a Gallon, and render an accommodation to English Measures quite feasible. But it is not certain that the Quart *will* be abolished, and it would be premature to argue on the supposition.

The Metrical System then that I would propose for India, as combining more decidedly than any other that I can think of, the three great objects, viz., assimilation to the English system, approximation to the existing Native system, and a means of testing both Weight and Measure of Capacity by the coin of the country, is as follows: I. For *Linear* measure, the English yard and foot, without at present defining the subdivisions. II. For *Land* measure, the Acre, decimally subdivided. III. For *Weight*, the Seer, of 2lbs. avoirdupois, corresponding to 77¾ Rupees weight; with a multiple of a "Mun" of 50 seers, (= 100lbs.) and sub-multiples of "Annas" or 16ths of Seers. IV. For Measure of *Capacity*, a "Seer-measure" identical with the English Quart, and defined as containing 97 tolas of Water at a temperature of 84°, (containing when struck, about a "Seer-weight" of mixed grain) with a multiple of a "Sotee" or 100 seers, and sub-multiples of "átees" or eighths.

It will be observed that in my proposed arrangement, no attempt has been made to introduce a *Decimal* scale; and to remove the supposition that I have (as many *do* have) a prejudice against a decimal system, I must, at the risk of egotism, explain that there are perhaps few unprofessional men who make more use of decimals than I do. I have for many years been in the constant habit of using the Slide Rule, essentially a decimal instrument, and it is more natural to me to write ·125 than ⅛. In my official capacity I have urged, and eventually with success, a decimal subdivision of the Acre in the new Revenue Survey of the Carnatic, and

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I have also had occasion to recommend a decimal notation of the Assay reports of the Madras Mint. My own feeling on the subject would therefore make me most anxious to adopt a Decimal system, and I would advocate it most strongly for England; but for India, as India is at present, I cannot do so conscientiously, for I am convinced that it will be difficult enough to introduce any new Metrical system among a people so peculiarly wedded to custom and usage, and that to attempt at the *same time* to introduce a new *notation* would result in a total failure. If Englishmen would consider how much they would object to a decimal subdivision of the *Day* and *Hour*, they would have some idea of the objection of the Natives of India to a decimal division of Weight and Measure. There is not the same difficulty in the decimal *multiples* of an accepted Unit of Weight or measure, as there is in the *sub*-multiples. In England there would be less difficulty in introducing Weights of 10lbs. and 100lbs., than those of 10ths and 100ths of lbs., and Measures of 10 and 100 Gallons, than those of 10ths and 100ths of Gallons, and it is on this account that I have proposed decimal multiples* and binary *sub*-multiples for India. The multiples of the seer will bear a definite relation to British Weights and Measures; the *sub*-multiples will not, but then the definite relation is not so much required when small quantities only are in account.

The question is not which is theoretically the best system, but which can be so introduced, as to secure equivalents with the British system, and at the same time preserve some established standard of the country. The intrinsic merit of a Decimal *Coinage* will not be denied, and yet I have not met with any one acquainted with India, who would venture on a change. The same reasons influence me in objection to a Decimal *Metrical* System for India. In some respects, the latter is of more difficult introduction than the former, Professor Airy, (the Astronomer Royal) stated in his address at the Institution of Civil Engineers, Feb. 28th, 1854, that "a decimal scale could be, and ought to be, enforced in *coinage*, but scarcely in any thing else;" and as regarded

* That is multiples of the SEER. No decimal multiples of the TOLA will correspond with English weights.

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Weight and *Measure*, it would be "perfectly vain."* It is however probable that the attempt will be made, but it is not *yet* made, and if this caution is observed in a country like England, it certainly ought to be exercised in India. A Decimal system is peculiarly adapted for *account*, but for the ordinary transactions of life, which affect the mass of the people, the binary scale is the most natural, and the most convenient in every country; and in India, the interests of the mass demand that it be preserved in the *sub-multiples* at least, of the Metrical standards.

Lastly, I will advert again to the fact that the Indian coinage is not decimal; the Rupee being subdivided into 16 Annas, and each of these into 12 Pies. Unless the coinage is altered,—a measure which I conclude the Government will not venture to attempt at present,—the chief advantage of a decimal Metrical system is lost. On this point I would refer to the evidence of Professor De Morgan, the ablest and most zealous of the advocates for a Decimal system in England. When examined before the Parliamentary Committee of 1841, appointed to consider the subject of the "Restoration of the Standards," the Professor stated that in his opinion "*no decimal scale is practicable, that does not begin with the money.*" (Page 60. H. 10.)

The next point for consideration, is the best method of *introducing* a new and uniform Metrical system into such a country as India, comprising as it does such an enormous extent of territory, and containing so many races of people speaking different languages, already possessing each their own established Weights and Measures, and deeply prejudiced against innovation.

It is the opinion of some who are acquainted with India, and whose views are entitled to respect, that the introduction of a new Metrical system should not be attempted by any compulsory measure, but be urged upon the people by encouragement, persuasion,

* The Decimal system was established by law in France in 1795, but as regarded Weights and Measures it was found that its enforcement was so difficult, that in 1816, the "systeme usuel" was enforced for Retail Trade. It was not till July, 1837, that it was decided finally to adopt the decimal scale, and to enforce penalties for the use of any other. The law came into force on the 1st of January, 1840.

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and personal influence ; in the same manner in short, as the introduction of European literature and science, or Christian ethics. I would submit however that the cases are not parallel ; we *must* wait for the one, we *cannot* wait indefinitely for the other. In the one case the Government has *no right* to compel the adoption of their views, however correct and beneficial ; in the other, it becomes a *positive duty* of the State to insist upon a just and definite mode of dealing among its subjects, and to introduce a new and uniform system, not merely because they have found a better one than any which exists in India, but because the existing ones are radically bad, and open a door to every kind of uncertainty, evasion, and fraud.

It does not require much argument to show that the Natives of India will not of their own accord do what the people of England would not do without a legal enactment, and if there *is* a Law, it must be compulsory, or it will be a dead letter. It would have been deemed useless to attempt the introduction of a uniform Metrical system by a Proclamation in the Gazette, or by official influence, in England, where all classes of people admitted the inconvenience of so much diversity, and it is not likely that such measures will be successful in India, where the people do *not* admit such inconvenience, and the petty dealers are *directly interested* in a continuance of the present irregularity. If official influence is to be exerted, it will probably end in that kind of influence which is virtually compulsion ; a species of argument not unknown to official subordinates in India, and which it would not be wise to encourage.

It may be thought that as it is already a penal offence to use false Weights and Measures, the public are sufficiently secured ; but there is little use in testing them as long as the Standards are *not defined* by law. I may mention a few instances that have come under my own knowledge, of the inconvenience arising from this laxity.

The first case was one, where the Land Revenue having been fixed originally with reference to the produce and price of grain, complaints were made of its pressure, in consequence of a continued fall (as it was asserted) of price. To ascertain the truth of

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this, was of vital importance, and investigations were made by Government, in the course of which it was discovered that in one District, the official "Price Returns" had been 20 per cent. in error for some years, in consequence of the grain-dealers having altered the capacity of their Measures. In the second case, a merchant at a seaport town, sold a certain number of "candies" of copper to a captain of a vessel, who found on re-weighment for sale at Madras, that the weight was short. The seller was able to show that he sold by the Candy where he resided, and if the dispute had not been settled by an amicable arrangement, no official authority could have decided the question, inasmuch as the Candy is so many Seers, and the Seer so many Rupees, but *what* Rupee no one can tell: certainly not the present one, which is some grains heavier than the Rupees of the Native mints, current when the Weights were originally established. In the third case, a long correspondence took place in the Military Department, in consequence of a dispute as to whether a regiment of Sepoys had not overdrawn their rations; it being asserted that the Seer-measure of the town where they were quartered, was too large. The Government requested the opinion of the Board of Revenue, but the only answer they could give, was that the Native "Seer" differed in different places, at the option of the bazaar-men, and that as the Government in their Proclamation had made *no mention of a Seer* for use "in Government transactions," there was no official definition of such a Measure. In the fourth case, the Board of Revenue at Madras were informed that Measures of Capacity were in use in the Town, bearing the Government stamp, and yet differing in capacity from the content prescribed by the Proclamation mentioned in another para. of this Paper.* These Measures were examined, and found to be 4 per cent. in error, but the Stamping Department asserted that they were in accordance with an *old Standard* in their Office, and the Government declined even to prohibit their Seal being affixed to Measures openly at variance with their own Proclamation. All these instances occurred within three or four years, and similar cases hap-

* Vide page 194.

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pen constantly, for want of some positive law on the subject, and the evil cannot be remedied by a mere Proclamation, which is not binding. It is now 10 years since the Madras Proclamation was published, and models distributed over the country with injunctions to the Public Officers to press their adoption; but, with very few exceptions, the attempt has failed, and those very exceptions only add to the discordance already prevailing. It is to little purpose for Government to proclaim a Standard, if its use is not enforced, or if it is not to be considered as decisive in case of dispute. It appears obvious, that where such inconvenient discrepancy and uncertainty exist, it is the duty of Government to decide upon some Standard, and having once decided, not to allow the people the option of accepting it or not. It will often happen that when a practice is insisted on by law, and penalties attached to its infraction, no resistance will be made; whereas if the people are aware that there is no law, and no means of enforcement, their opposition will be most pertinacious, and if they can only hold out long enough it must be effectual.

It may be said that in some of the Bombay provinces a new Standard (referred to in para. 55) has been introduced with success without legal compulsion. That a reform in the *Weights*—that is, selecting the best known of those already in use—has been partially carried out by the personal influence of some energetic magistrates, is no doubt the case; but as regards the *Measures* of Capacity, a most important branch of metrology to the people of India, the attempt has only succeeded apparently, in one or two instances; and to show how little is to be expected from the progress of education, and march of intellect, the reform has been found impracticable (there being no *law* to enforce it) in the towns of Bombay and Surat, where it might be supposed that official influence and educational enlightenment would have aided the desired object.*

Even in those cases where the shopkeepers are *said* to have adopted the new Weights and Measures, assertions are not suf-

* The total failure of the late Municipal Act, in the Madras Presidency, may be cited as another instance of the insufficiency of a non-compulsory Enactment to effect social reform, however needed.

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ficient. To my own knowledge, when the subject was under investigation at Madras, Reports were received from two Districts, most positively asserting that the Government Standards were in use ; but on subsequently *sending for* Measures actually used in the bazaars, it was ascertained that the Civil authorities had been misinformed completely. The statements of Native subordinates cannot be depended upon in these matters, and they err often from sheer ignorance ; if it is wished really to ascertain whether certain Weights and Measures are in use, the magistrate must not hear with his ears, but see with his eyes, and nothing less ought to satisfy Government.

Having thus given my reasons for believing that it is hopeless to expect a reform of so great a magnitude as uniformity of Weight and Measure throughout India, without some Legal enactment, I would not be unmindful of the fact that great caution would be requisite in carrying out that object. No Government should promulgate any law which it is not able to enforce, or any which cannot be enforced without oppression and tyranny. For these reasons, the enactment of a compulsory law as regards uniformity of Weight and Measure to take effect *all over India*, and *at once*, would be highly objectionable. It could not be enforced at all in remote and thinly inhabited districts, and in many localities where it *could* be enforced, the advantage to be derived from it would not compensate for the inconvenience and annoyance resulting from its compulsory introduction. I would therefore advocate a movement to be made determinedly, but gradually, both as regards place and time.

The enactment might be made applicable in the first instance, only to the towns of Calcutta, Madras, Bombay, and Agra ; to all Military Cantonments and to such towns as the Government of each Presidency might think fit to recommend ; and a distant but distinct date (say one year prospectively) should be fixed for the commencement of its operation.

By limiting the immediate action of the law to the principal Towns and Cantonments, its enforcement will be practicable, and benefit to be gained, sufficient to justify the employment of what may be to some an unpalatable exercise of authority. It may be

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reasonably expected that the people of the interior, in their traffic with such Towns and Cantonments, will gradually acquire a knowlege of, and a convenience in conforming to, the Standards; so that in a further period of time, the local operation of the law may be extended. As regards the Towns and Cantonments specified, there will be time beforehand for the people to make themselves acquainted with the new standards, to prepare new sets of Weights and Measures, and arrange their prices accordingly. During this period also, every assistance and encouragement should be given by the officers of Government to those who are likely to be inconvenienced by the measure. " Suaviter in modo, fortiter in re."

All Government transactions, accounts, tariffs, &c, should be in terms of the new System, and in every purchase made by the Public Departments, their own Standard Weights and Measures should be employed. This would supersede the attempts (always futile) to specify on every occasion, in equivalent terms of the authorised standard, the ever varying and uncertain values of the Native Weights and Measures. For general purposes, and as a guide to the Departmental officers, Tables of equalization should be prepar-for each District, showing the *average* results of experiments made to determine the value of the local Weights and Measures. Such Tables though useful, will not of course be conclusive in every case of purchase, inasmuch as Weights and Measures differ in different villages, and the Tables can only give the result of the average of the District. Such Tables have been lately compiled in the Presidency of Madras.

In order to prepare the people for the reception of the new Standards, not only should they be enforced in the chief Towns, and used in all Government transactions, but they should be explained in all the Government schools, vernacular tracts on the subject should be freely distributed, models should be kept in store in all public offices (both for ascertaining the true equivalents of the Native Weights and Measures, and to enable those who wish to take copies), and it should be constantly and publicly notified that the operation of the Act would be eventually extended to every bazaar in the country. The Chambers of Commerce, and the Railways and other Companies, should be urged to co-operate, even in

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localities where the Act did not as yet apply, and if the Metrical system adopted, be one which conforms to English Weights and Measures, compliance would be the more easily afforded.

The Enactment should authorise only *struck* Measure, without making heaped measure actually illegal. By clause 7, Act 5th and 6th, Wm. IV. cap. 63, all bargains, sales, and contracts made by the heaped measure are declared null and void: and every person who sells any article by the heaped measure, is liable to a penalty of £2. Considering the repugnance of the Natives of India to struck measure, it would not be advisable at present to make such stringent provisions, but it should be distinctly notified that the system is adapted only to *struck* measure, that no purchaser has a right to demand any other, and that in any suit or action, where Measures of Capacity are called in question, the law will recognise none but *struck* measure. It will also be of importance carefully to explain to the Native trooops what the new Weights and Measures are, and that none but *struck* measure will be recognised in rations or allowances.

With regard to dealings in *grain*, there is no doubt that *weighing* is a more accurate test of valuo than measurement, but the latter is so much more expeditious and convenient, that it will always be resorted to by the Natives of India, especially as long as the present rudeness of their Balances remains unimproved. In England and Ireland, corn is always sold by weight in the wholesale transactions of large Towns, and many of the difficulties that occur in the Grain Contracts of the Indian Commissariat would be obviated, if their purchases were made by weight. The sale of salt by weight, in the levy of the Excise, should also be insisted on.

Magistrates should be empowered under the new Act, to appoint Inspectors, but no penalties should be inflicted except where the Weights or Measures were tested in the presence of the Magistrate, or his Deputy, and it would be well to deal leniently in all cases where there was no wilful error, fraudulent intent, or repetition of offence.

It may be expected that when the time comes for enforcing the operation of the Act, some attempt will be made in the large towns, to resist it, by a combination of the grain dealers to close their shops as has been tried on some occasions with success. Provision for this should be made in the Act.

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It should also be considered how far Government should endeavour to relieve the shopkeepers and others, of the expense of procuring new Weights and Measures, by making them up in the Arsenals, and selling them below cost price or taking old Weights and Measures in exchange. In England the Parliamentary Committee of 1841, stated that it would cost the Government about £200,000 to make new *Weights* alone, but they considered it would be worth the expense.

There will be other details to be considered and embodied in the Act, which may be left for future discussion: such as the stamping of Weights and Measures; the using of Casks, Bottles, Jugs, &c. representing some defined Measure; the material with which Weights and Measures should be made; what articles should be sold by weight only; rules as to the publication of Price Lists; duties and powers of Inspectors; amount of fines and forfeitures, and mode of recovery; periodical re-verification of stamped Weights and Measures, &c.

In concluding this Paper, I would wish it to be understood that I do not presume to set forth my individual opinion as at all decisive. My object is, to obtain for so important and complicated a subject that careful consideration which has not as yet been conceded to it, and I would venture to express the hope that the Government of India before finally deciding on a Metrical system, from which if once promulgated they cannot retract, will obtain the opinion of persons in all the Presidencies, interested in the subject, and qualified to enter into it *in detail.* To those who are inclined to take the subject into consideration, I would submit that the question is not merely which is "per se" the most correct system of Metrology, but which is best for India; and that the essentials to be *combined* if possible, are I. The preservation of some standard of Weight and Measure common to the whole of India. II. The adaptation of the Weights and also the weight of *water* contained in the Measures of Capacity, to the current coin of the country. III. A definite but simple proportion (without fractions) between the Weights and Measures to be now introduced, and those of Great Britain. It will also be necessary to bear in mind that the *coinage* of India is not decimal, and there is no intention of changing it.

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Memorandum by Mr. Bate, being an Enclosure in a Letter from the Court of Directors of the E. I. Company to the Government of Madras, dated 6th July, 1829, on the occasion of forwarding Standard Weights and Measures in accordance with Act 5, Geo. IV. cap. 74.

TABLE I. [Thermometer]

Temp. Fahr.	Grains to add or deduct.
55°	+ 25·30
56	+ 22·46
57	+ 19·36
58	+ 16 00
59	+ 12·38
60	+ 3·56
61	4·38
62	— 0 00
63	— 4·62
64	— 9·49
65	— 14·60
66	— 19·94
67	— 25·52
68	— 31·33
69	— 37·38
70	— 43·63
71	— 50 06
72	— 56·69
73	— 63·52
74	— 70·55
75	— 77·78
76	— 85·21
77	— 92·84
78	— 100·67
79	— 108·70
80	— 116·93
81	— 125·36
82	— 133·99
83	— 142·82
84	— 151·85
85	— 161·08
86	— 170·51
87	— 180·14
88	— 189·97
89	— 200·00
90	— 210·23
91	— 220·66

At a temperature of 75° Fahr. a Gallon of distilled water weighs 77·78 grains *less* than 70,000 grains. Or 70,000 grains — 77·78 grains = 69922·22 grains.

TABLE II. [Barometer.]

Barometer Inches.	Grains to be added or deducted.
·01	·0246
·02	·0492
·03	·0738
·04	·0984
·05	·1230
·06	·1476
·07	·1722
·08	·1968
·09	·2214
·1	·2460
·2	·4920
·3	·7380
·4	·9840
·5	1·2300

Ex. Suppose the Barometer at 29·54 inches. (*below* 30°)

·5 = 1·2300
·04 = ·0984

1·3284 grains to be *deducted* from the Gallon of 70,000 grains.

If the Barometer is *above* 30 inches, the grains are to be added.

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The following Abstract adapted to lbs. avoir. and to Tola (or Rupee) weights, has been prepared from the above.

Temp.	Grains of water in 100 cuibc in.	Diff. in grains.	Avoir. lbs.	Tolas.
80°	25203·6		3·6005	140·020
81°	25200·6	3·0	3·6001	140·003
82°	25197·5	3·1	3·5996	139·986
83°	25194·3	3·2	3·5992	139.968
84°	25191·0	3·3	3·5988	139·950
85°	25187·7	3·3	3·5983	139·932
86°	25184·3	3·4	3·5978	139·913
87°	25180·8	3·5	3·5973	139·894
88°	25177·3	3·5	3·5968	139·874
89°	25173·7	3·6	3·5963	139·854
90°	25170·0	3·7	3·5957	139·834
91°	25166·2	3·8	3·5951	139·812
100°	25129·0		3·5899	139·600

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IX. *The Study of Living Languages.* *By* COLONEL ARTHUR COTTON, *Madras Engineers.*

The learning of the living languages of foreign, semi-civilized, and savage people has now become a matter of such immeasurable importance that any man may be excused who makes the poorest attempt to diminish the difficulties of such a work.

Englishmen especially, are at this moment employed by thousands, as Merchants, Missionaries, Magistrates, &c., in learning hundreds of different languages spoken by people in all stages of civilization, from the lowest state of society upwards, and in their speedy acquisition of a correct knowledge and free colloquial use of several tongues of those tribes, hundreds of millions of the human race are most deeply interested, as that upon which mainly depends both their temporal and eternal interests. Yet I am not aware that there is in existence a single work in which this subject is closely and systematically investigated. It must be observed that the point before us is, what is the best mode of acquiring a knowledge of the language of savage and semi-civilized nations? and that this is in some important respects quite distinct from both the acquisition of dead languages and also of the living languages of nations who have been fully civilized and, consequently, have a complete system of literature, a great variety of books of instruction written by extensively informed Natives and also thoroughly educated teachers.

There are difficulties in learning the languages of semi-civilized and barbarous people which do not exist in the case of the languages of civilized nations, and with respect to the dead languages the principal points to be attended to and the objects aimed at are so entirely different from those in living languages, that what is applicable to the one is almost entirely inapplicable to the other.

Nothing can be more deplorable than this state of things. The mischiefs arising out of it are incalculable. All, without exception who require to know such a language, and who make attempts to acquire it, lose, probably from three fourths, to nineteen

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twentieths of the time so employed; a large portion lose the whole, breaking down before they have acquired any useful knowledge at all; probably scarcely one in ten acquires a tolerably correct and free use of it, and scarcely one at all such a knowledge as to make them really effective translators, an office of the highest possible importance, because the transference of English literature, for the great mass of the inhabitants of the earth, must precede the formation of a national literature among each tribe.

At present it may safely be said that no system whatever is followed in studying such living languages for colloquial purposes. Let any one individual of the thousands who are at this moment so employed, be asked, whose system of study do you prefer, or have you any of your own, and upon what grounds do you decide upon this, or that point, and his answer would generally be such as to show that be had no clear, definite, well-digested ideas on the subject. Without the least previous investigation of the subject, without spending one single day in reading a treatise on it, or considering it in his own mind, he usually blindly takes in hand a matter upon which he will perhaps employ one or several years; taking at a venture as it were, any books or teachers that he may happen to fall in with, or any ideas he may happen to have got into his own head, he knows not how or whence; without any solid grounds for concluding whether the mode he is pursuing will lead to an economical or an enormously wasteful expenditure of time, and, what is of more importance, whether he is laying the foundation of a real, correct, and effective knowledge of the language, or establishing himself in a totally false use of it, which, when become habitual, will never be corrected.

Matters are in respect of this study of languages just as they were in respect of road making before the time of Mr. McAdam. Every man thought he was born a road maker, and those holding the charge of roads did almost anything to them and called it repairs. It was a most common thing for instance to throw a thick layer of loose rounded gravel on the road, which at first caused almost the greatest possible resistance to the carriages and by degrees was converted into mud, but never afforded any thing ap-

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proaching to a clean, hard surface. The road menders were quite satisfied because they were doing something, but if asked, why they did what produced an effect exactly the opposite to that which was desired, they of course could not have given a reason. Road-making has since been thoroughly investigated and though men have not yet perhaps found out the best way of doing it, they have now a real reason for what they do, and consequently a prodigious improvement in roads has been produced.

It is high time that such a change should take place in reference to this subject now before us, and any attempt at an examination of it, with a view to a really sound system of study should be accepted.

The thoughts contained in the following paper are the results of such a consideration of the subject as could be given to it in the midst of duties of another kind during a period of more than thirty years.

Circumstances have not allowed of the writer following up the study of any language, to any extent, having repeatedly moved, from where one language was spoken to where another was used, and his time being too much occupied with pressing business; nor has he had an opportunity of commencing the study of a language with such materials, as he here recommends, ready prepared to his hands.

In the course of this long period however he has had an opportunity of trying his plans partially in several languages both on himself and others, and thus of correcting in some measure his first ideas and forming something like a digested system in his own mind; and he must state that as to the leading points in the system here proposed, he has quite satisfied himself.

He has taken every opportunity of obtaining aid from others, both by reading works of teachers of languages in Europe, and also by trying to discuss the question with those who were studying and had studied such kind of living languages. From the former he has received some help, though often merely by being taught what to avoid; but from the latter he received no assistance,

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simply because in general they had no distinct ideas at all on the matter, nor any solid reason for any thing they had done in their studies. He has however got various hints from observing what progress different men had made in such studies when using different means. On one occasion he met with a young man who had given his whole time to Arabic for three years, and could not then produce a sentence in conversation, and soon after he was intimate with another who in about 8 months and while loaded with other duties, had obtained, if not an accurate yet such an *effective*, colloquial use of the same tongue, that he regularly transacted extensive business in it with strangers of all sorts without the least difficulty. Again, in India one meets every day with men who have studied most diligently for one, two or three years, and yet all their life after speak a language, that both from pronunciation and expression is almost, or quite, unintelligible to any Native, excepting those who from being about them constantly in an official capacity have *learnt their* language, (for what they used and called the Native language was really a language of their own invention) and so have come to understand them.

The writer cannot conclude these remarks without expressing his full assurance that the acquisition of a correct knowledge and perfectly ready colloquial use of such languages will be found to be a matter requiring very little time compared with what it does at present, in most cases, when a better mode of learning is adopted. On one occasion he had an opportunity of observing the progress made by children in acquiring a new language in a certain time. Out of a number that embarked in a ship in India many did not know a word of English, having previously used nothing but some Indian language, and they were of various ages. During the four months of the voyage to England every one of them had so perfectly acquired the use of English that they never were at a loss, and latterly seemed to have as good a knowledge of it as those who had always used it. Now if children of a few years old, without the slightest assistance from teachers or study, could thus pick up a colloquial use of a new language in four months and talk it exactly like one who had never talked any thing else,

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it seems certain that adults with a hundred times their power of mind and with suitable books and teachers and regular study could not fail to attain to a real knowledge and ready colloquial use of a new language, and that without being years about it, unless they were altogether wrong in the method of study they adopted. In fact he cannot help declaring it as his opinion that when this subject is fairly grappled with by men, the great supposed obstacles to intercourse of strange languages will be found, comparatively speaking, a mere bugbear; and that the acquisition of a new language for all the ordinary purposes of life will be found to be within the reach of almost all with a comparatively very small expenditure of time and labour.

Before proceeding to propose a system of study of living languages, it may be well to make some remarks on the mistakes that are commonly made at present, and the chief difficulties that are usually met with, as well as on the time generally expended on such study.

A great many of the common mistakes can easily be traced to the circumstance that almost universally the students have previously been accustomed to study dead languages, and from their not observing that almost all their ideas have been formed from *that* study, while the principal points to be attended to in the study of living languages are exactly those that are of little or no consequence in that of dead ones, and *vice versâ*. In learning Latin or Greek, for instance, the sole objects usually are to be able to read so as to understand the writings of highly educated men and (but as very secondary) to write elegant formal essays. The following are therefore the leading points aimed at;

1st. A knowledge of the character.

2nd. A knowledge of the whole vocabulary of the language, including a multitude of words seldom or never used colloquially in the ordinary business of life.

3rd. A readiness in perceiving the meaning of long involved formal sentences, such as are found in grave prose and in poetical writings.

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4th. A thorough knowledge of the whole grammar, so as to be able to give a formal rule for any thing when questioned.

5th. And such a familiar knowledge of the idiom of the language as will enable one to write formal papers in a good style.

The points that are of little or no consequence are,

1st. Correct pronunciation.

2nd. An extensive knowledge of the common expressions used in the ordinary business of life.

3rd. A perfect readiness at recognizing the word by the sound when rapidly spoken.

4th. The same in forming sentences to express our own thoughts.

Now, if we consider these things we shall perceive that the study of the dead languages and that of the living languages of semi-civilized and barbarous nations are almost diametrically opposed in respect of the objects to be attained. The points that are essential in the one are either non-essential, or of no importance whatever in the other and *vice versâ.* A man may talk a language most fluently, correctly and usefully, for all the ordinary business of life, without knowing the character, without being able to quote a single rule of grammar, without the knowledge of half or three-fourths of the vocabulary of a language, and without any facility in comprehending the involved sentences of formal writings of learned men ; while, without an accurate pronunciation, an ample acquaintance with the common colloquial expressions of uneducated people, and a most free and ready use of them, so that strangers can readily catch his words and comprehend his meaning, and without an ear thoroughly exercised in the sounds of the language, so as at once to recognise what is spoken by a Native, he has entirely missed his object, though he may know every word in the language and every rule of grammar, and be able to write an elegant essay without a mistake. Books of history, &c. do not furnish us with the expressions of ordinary conversation. *Every country has its own peculiar forms and they must be learnt individually ;* no rules can be given by which a student, who knows the words and grammar, can invent them himself. In semi-civilised countries, where not

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one in a hundred has read books, there is a large proportion of the words, which are never used in conversation on ordinary matters, and which therefore are so far from being of any use to the great mass of those who have to acquire the language that they are always in his way, if he has learnt them, leading him to express himself in words not in common use, and consequently unknown to most of those with whom he has to communicate. So far therefore from it being sufficient to follow the ideas which a man has gathered while studying dead languages, they are in fact the very opposite to those which are correct as respects the study of such living languages as are here supposed.

If we examine the mode of study adopted generally, however it may vary in minor points, the system, so far as that can be called a system, which is indeed no such thing, is that suited to the dead languages. A man takes up a book of stories, a grammar, and a dictionary, and learning, almost exclusively by the eye, he proceeds exactly as if the use of his ear were of no consequence, as if he must at once grapple with the whole vocabulary of the language, and as if when he had got the materials of words and rules of grammar, he could himself guess the forms of expression which he must compound from them; like the idiot who was found to have stored up in his box all the wheels, axles, &c., he could lay his hand upon, thinking that when he had got enough he could easily make a clock of them. The results of this proceeding are notorious. A youth in India has passed a splendid examination, knows every word of the language and has a rule of grammar for everything, loses his way out riding and cannot get home before he is in danger of a stroke of the sun, because he cannot make any Native he meets understand him, nor can he understand a sentence spoken by them, and this after many months, often a year or two, of intense study from morning to night. And what is still worse, probably he is confirmed in a false pronunciation and a false mode of expression from having almost entirely neglected these two great essentials, or at least not having given them any thing like due attention. The consideration of this source of many of the most serious mistakes that are made in this study will be very useful.

Another great source of mistakes, is that such languages are

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generally learnt by men at that age when they have most confidence in their own powers and when they are consequently always disposed to take the bull by the horns. With this feeling the student generally rushes into the midst of his enemies headlong, attempting to grapple at once with the character, the pronunciation, the whole grammar, the whole vocabulary of 20,000, or, as in Arabic, 200,000 words, the language of books and the language of conversation, &c. No wonder that such a one finds himself continually discouraged, that many give up in despair, that all waste an enormous amount of time and mental effort, and that scarcely one in a hundred ever talks like a Native. Whatever a man's powers may be it is certainly sheer waste to set about matters in this way, and he cannot possibly receive such clear impressions on his mind as the same person would, if he concentrated his attention upon one thing at a time.

It may also be well here to advert to some peculiar difficulties which we necessarily encounter in the circumstances in which Europeans are ordinarily placed in semi-civilized countries, and especially in a country like India, in which caste prevails. If an Englishman wishes to learn French or German, he can go and live with a Native family, or throw himself continually into the society of Natives, in inns and places of public resort, where his ear wil be exercised from morning to night in the true pronunciation and the real ordinary expressions of the language, and where consequently, without the least effort even, though indeed slowly, he can hardly help acquiring a correct use of the language both as respects pronunciation and expression. But there are few countries out of Europe where a European can thus freely associate with the Natives, and in India he is effectually excluded from their houses. Separate and special means must therefore be used, to exercise the tongue and ear of the student, and to store his memory with a stock of bonâ fide expressions.

Another difficulty is the great inferiority of Native Teachers compared with European Masters. Indeed in a great proportion of cases a man has to learn a language with the assistance of one who is not a teacher at all by profession, and who therefore can-

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not give him a hundredth part of the help derived from a practised and well instructed teacher. Further, such languages are so extremely different from the European tongues, in every respect, that a person is much more likely to be discouraged from the difficulties he experiences than in learning a foreign European language, and on this account it is especially necessary to adopt a system that shall as far as possible tend to *keep up the student's courage.*

These are some of the leading points that should be kept in view in considering a system of study for such languages.

I would now propose some fundamental principles to be taken as clues to the better understanding of the subject.

It is evident that there are two fundamental points to be attended to. The first, which is by far of the greatest importance of the two, is; To be careful that we lay a sound foundation. This is a universal principle and yet one at least as often forgotten in studying languages as in other matters. If a false foundation is laid, the erection can never be made sound. If a man once acquires a false pronunciation or a false mode of expression he will never get over it. Whatever he learns should be perfectly correct, and not only so, he should have such a thorough knowledge of it that he shall be fully assured in his own mind that his knowledge is correct, so that he may not afterwards be in doubt and liable to give up what is right and substitute some guess of his own instead. For want of right modes of study, what numbers use all their lives some language and pronunciation of their own invention and never find out how it is they can hardly have any intercourse with Natives by means of it. The true *value* and true pronunciation of every word encountered should be fully ascertained, and its use in a great variety of forms of expression should be made thoroughly familiar, before proceeding to other words, and no imperfect acquaintance with a word or expression should be allowed. The second great principle is of course; To save time; but this must always be subordinate to the former. In the main however the two principles are not only compatible but inseparable: nothing causes so much waste of time as imperfectly learning things, receiving indis-

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tinct and shallow impressions of them, because such things are always forgotten and have to be learnt over again. This is the grand reason why such enormous time is wasted in this study. A man attempts so much at once that every thing is partially learnt and forgotten probably at least a hundred times over. He begins with a book containing hundreds, more likely thousands of words and long sentences involving innumerable rules of grammar, and before he gets to the end of it has learnt in a sort of way and forgotten every word in it and every expression over and over again, and has probably in the end thoroughly apprehended and acquired a familiar knowledge of not one twentieth part of the words he has met with. He perhaps makes lists of the words that he meets with and learns many hundreds by heart at once, but he has no useful knowledge of one in twenty of them. No word is effectually known till it is so thoroughly familiar, that it is ready in his mouth at any moment, without the slightest effort of memory, and till it can be used in a considerable variety of expressions; in fact, till it is just to the student like one of the words of his native tongue, and so wrought into his mind that it cannot be forgotten again. It may however often appear that time would be gained by adopting some plan which would endanger the soundness of the foundation, and in this case such a plan must be rejected.

The third great principle is ; To have such a system as shall encourage people, both to commence upon and go through with the study of Native languages. It is of exceeding importance to encourage all persons, whatever their situations or occupations are, when remaining for any time however short or uncertain in such countries, to make themselves acquainted, as far as possible, with the language of the people. Numbers at present never attempt it, solely because the usual mode of study cuts them off from all hope of ever attaining to the smallest useful knowledge of it, without such an expenditure of time and labour as they are afraid to encounter or their circumstances absolutely prevent. A system which shall afford some useful results to every one who enters upon it, and those in some degree proportioned to the time and labour ex-

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pended, is an immense desideratum. It would lead numbers to make a beginning who now never attempt it; and many such, if they once began, would not rest till they had obtained some considerable knowledge of it.

An encouraging system is equally required for those who do at present set themselves to the study with the purpose of going through with it. Nothing can be more discouraging than the means usually pursued at present, whereas if a man were pursuing a system in which he felt at every step, that he was making real useful progress, he would go on with tenfold spirit, always feeling too, that stop where he would, his labour had not been thrown away. In endeavouring to accomplish the first object the following rules may be laid down.

1st. The student is really to *learn* the language and not to attempt to *teach himself*. For instance, nothing is more common than for a man, as soon as he has learnt a few words, with the help of his grammar to begin to try and form sentences. In this way he may certainly make a new language of his own, but it will not be the language he proposes to learn. Thus numbers attempt to communicate with Natives by English sentences made up of foreign words which consequently are not merely scarcely intelligible but often convey no meaning at all, though perfectly correct as regards both words and grammar. The student must not at first attempt to take the smallest step alone. He must not pronounce a word nor put two words together by himself. He must be content to *learn* every thing, and that thoroughly, from a Native, sound by sound, word by word, expression by expression, and not attempt to go beyond this, till he has become so established in correct pronunciation, in his knowledge of the correct value of words and in the actual forms used by the Natives that there is no danger of his substituting something of his own for the real language.

It is by no means sufficient to learn a sound or expression once or ten times: it can only be correctly acquired by exercise, by thousands of repetitions, referring every time immediately to a correct standard. If a man reads for an hour with a teacher and then goes attempting to pronounce the words by himself for the rest of

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the day, he will inevitably acquire a false pronunciation, unless he is so thoroughly established in a correct pronunciation that there is no danger of his losing it and then indeed abundant exercise of his tongue, when alone, will be of the utmost use, but this at first is ruinous.

Suppose a child were shown the form of a letter and then as soon as he had a rough idea of it should go on writing repetitions of it without a standard before him, any body can tell what would be the consequence; at the end of a month he would be thoroughly confirmed in writing such a letter as had never been seen before; and if he had occasionally the standard put before him, the consequence would be that nine-tenths of his time would be passed in learning to recede further from the original, and the other tenth in trying to get rid of the habit of writing wrong and to bring himself back to what was correct.

The same is the case with the student of languages, and in general they are thus constantly employed in partially learning and then unlearning, and the consequence is that even where an approach is made to a correct use of the language nine-tenths of the time employed is needlessly lost.

A third point is to learn one thing at a time.

If a number of things are pressing upon the attention at once, it is impossible that a distinct and permanent impression can be received by any mind whatever its powers. Let us consider a person learning a language in the way so commonly followed. He is grappling with a sentence of many words. Here he has at once to consider the character, the meaning of many new words, the pronunciation of them all, the inflexions of the nouns and verbs, the syntax, the mode of expression, &c. The consequence is, his attention is so overwhelmed and distracted that his mind is incapable of receiving a clear impression on any one point. No wonder that so little progress is made, that the knowledge acquired is so imperfect and incorrect, and that the student is so constantly discouraged. Often his progress is one continued effort to bear up against the most depressing feeling that he can never master the difficulties, as a man wears himself out sometimes in trying to carry a load be-

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yond his strength, when if he would divide it and carry a portion of it at a time, he would not only accomplish his task and that comfortably, but would gain strength by the exercise. How many especially in hot climates are so injured in their health, not by learning a language, but by the way in which they learn it, that when they have some use of it they are obliged to lay by for a time. Whereas if they would learn one thing at a time, they would attain to such a clear and sound knowledge and go on so comfortably that they would be in no danger of ending without an effective use of the language.

A fourth point is to take care to give the whole strength to the really essential parts of the subject. What are the things that constitute a sound knowledge in this case? Certainly not a loose imperfect idea of the value of almost all the words of the language, with a rough guess at their pronunciation and the mode of putting them together, the power of reading the character, of understanding a book with the help of time for consideration, of recognizing the words by sight, &c. This is the foundation that is usually laid; such a student now commences to apply his knowledge of the language to the principal, perhaps the only purpose for which he has studied it; viz., conversation. He finds of course that his being able to recognize the words when he sees them is of no use to him; he has no facility in recognizing them by the ear, which was the only thing he required; he says the Native, he is attempting to talk with, speaks too fast. The fact is that he has not been learning the one grand thing he had to learn, the use of his ear. Next, he finds his knowing all the words in the language, in a certain way is of little or no use to him, because what he needs is the perfectly ready, familiar use of one in ten of them, but he cannot put a dozen together in that ready way which is necessary for conversing.

Next, when he has with much difficulty put a sentence together he is paralyzed by seeing a civil, enquiring stare on the countenance of his companion, in consequence of the imperfection of his pronunciation, and the English mode of expression he uses. His failure usually produces utter discouragement, unless he has such

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a good opinion of himself that he attributes it entirely to the stupidity of the Native. In reality he has been giving the whole of his attention to matters that are of little or no use to him, while he has almost entirely neglected those that are essential.

This brings us to the fifth principle, that *the language must be learnt by the ear and not by the eye.* This is one of the great fundamental mistakes made almost universally in studying living languages: the student never for a moment studies without seeing the words, though he knows that his whole object is to recognize them by his ear, without any assistance from the eye. A man might just as well attempt to train himself for a walking journey by sitting down for a year and turning a winch with his arms, or try to strengthen his limbs by moving for 6 months on crutches. Every body knows the consequence of this system, but every body pursues it. From the first the ear must be the main medium of receiving instruction and though the eye may be used a little at first with some advantage just to help the memory, yet after a little time the ear should be employed alone in conversation.

A man may consider he has laid a sound foundation when he has made the following acquisitions.

1st. The perfectly accurate pronunciation and thoroughly familiar knowledge of a certain number of the most generally used words, however small, so that they are to him exactly as words of his own language, that is, that he has not to search about in his memory for them when he wants them, but that they will come of themselves, and these pronounced so that a Native cannot but recognize them.

2nd. The power of putting these together in a good number of real bonâ fide Native expressions, however short, without any effort, expressions which he can confidently use, because he knows they are real, as he actually learnt them from a Native, and not ones that he has invented and which consequently may or may not convey the meaning he intended or any meaning. One will often hear a Native who has learnt English at a school use a sentence which is unexceptionable as to grammar, &c., but which is objec-

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tionable as conveying no meaning whatever to an Englishman. Thus a Tamil man may say in English, "If you see this that is good," and the Englishman to whom it is addressed cannot even guess what he means to express, though the same expression conveys a clear idea to the Tamulian.

3rd. An ear so exercised in the sounds of the language that the words spoken by a Native, if they have been learnt, are at once recognized by the student so that what is said within the limit of the student's vocabulary can be apprehended at once without seeing the words written, and without a moment's consideration.

4th. The knowledge of so much grammar as is necessary to form sentences of a few words only.

This is the sort of knowledge of a language that a child of three or four years old has. He does not know a single rule of grammar he cannot perhaps read or write a letter, his whole vocabulary probably consists of a thousand words, but within the limits of the matters he has to converse about, he can say with perfect freedom and almost perfect correctness any thing he wants without a moment's hesitation, and he understands on the instant every thing that is said to him, and that even though some of the words used are unknown to him. He has in fact a sound foundation, what he knows is real, and he has only to go on adding to his stock of words and expressions, and to correct some unimportant errors, which however are such as do not in the least prevent his being understood. An adult student, who has such a knowledge, is in a right position, because he can converse within certain limits, and therefore he is in the way of exercising himself *in contact* with a correct standard, and he has nothing of consequence to unlearn; his progress is not stopped by established habits of false pronunciation, and false expression, nor by habitual dependance upon his eyes to assist his memory. His only care then in conversation should be, not to attempt too much, but to content himself with common subjects and simple expressions, and only giving himself more liberty, as by learning he increases his stock of words, expressions, &c. The knowledge of the character has nothing to do

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with this foundation, it is not in any way an assistance in acquiring it, and it is a great hindrance. A child uses his language freely and correctly without knowing a letter. *The character has no connection with the pronunciation of a language*, which must be learnt by the ear alone, and the sounds so acquired are just as well represented by the student's own letters as by any others. Neither is a knowledge of almost the whole language necessary to it, the words in common use about ordinary matters form only a very small proportion of the words of a language, and three-fourths of the words which occur in the books ordinarily read are of no use whatever to the beginner; they are on the contrary the greatest hindrance to him by preventing his thoroughly learning those that he ought to have a familiar use of. Let us recapitulate the things necessary to form a sound foundation.

1st. A small vocabulary thoroughly known and become as familiar as the words of one's mother tongue.

2nd. An accurate pronunciation of these and the organs of speech thoroughly exercised in them, so that they can be spoken with perfect freedom.

3rd. So much grammar as is necessary to put these words together in short simple forms of expression.

4th. An ear so thoroughly exercised in the sounds of the commonest words as spoken by a Native that they can be instantly recognized when *heard*.

5th. The knowledge of a considerable stock of the commonest expressions of the language, so that the words known can be made into bonâ fide sentences.

When such a foundation has been laid, the student has only to proceed to add more words, more grammar and more expressions by degrees, only taking care to learn nothing but what is immediately wanted and to learn thoroughly whatever is learnt at all. When considerable progress has thus been made, he may proceed to learn the character if he requires it and to read books, &c.

Let us now consider more particularly the second main point, viz., to save time.

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As in other matters, the right way of acquiring a correct knowledge of a language will be found to be suitable for the attainment of this main object also.

The things that are necessary to ensure a sound foundation are equally so to secure the saving of time; but we will now consider the details especially with reference to the latter. The first thing then is, to do one thing at a time. Surely this is a principle that will at once commend itself to every one. We have to learn the character, the words, pronunciation, the grammar, the expressions, &c. Our plan therefore should be as far as possible to separate these, and have the attention concentrated upon one of them at a time. This certainly cannot be fully accomplished; but it can be sufficiently, for practical purposes.

The second is, to learn thoroughly whatever is learnt. How can there be any question about the waste of time produced by partially learning things and so forgetting them over and over again? We may safely say that, as ordinarily studied, the meaning of every word, its pronunciation, points of grammar, expressions, &c., are partially learnt and forgotten again hundreds of times over. Everything that is learnt should be so followed up that it may be indelibly fixed in the memory and be as much part of the student himself as any thing in his own language.

Thirdly, learn only what is really wanted. Surely this also is most obvious. To learn at first words which will either never be of any use to him, or not till he is far advanced in the language, is entire waste of time. The same with forms of expression, &c. An Englishman never thinks it necessary to learn all the words of his own language, he never knows half of them, much as he reads; and how many must there be in every language that he need never know. The student should first begin with such words as are of universal use in common life and then, when he has made some progress in the language, commence upon those which are necessary for his particular profession. Even in English there are numbers of words which, though common in books, are never used in ordinary conversation; but this is much more the case in languages in which ninety nine hundredths of the people scarcely ever read a

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book at all. To the beginner such book words, as he cannot distinguish them from others, are nothing but a serious hindrance to him.

Bishop Heber remarks that to make himself intelligible to the great mass of his hearers who were uneducated persons, he used to find it advisable to confine himself as far as possible to words of Saxon-derivation, that is, to words commonly used in conversation. If such a precaution were necessary in England, how much more in semi-civilized countries.

Can there be any question but that by a system of study based upon these principles, by far the largest part of the time usually spent upon acquiring a colloquial use of a foreign language may be saved. Look at the progress a child makes in a really useful knowledge of a language, whether his first, or one picked up afterwards, from being associated with those who speak it, with such extremely small powers of mind, without any effort, and without any materials. Can it be supposed that an adult with such enormous advantages, with properly prepared materials, and with diligent study could not make much more rapid progress, if he pursued a right system.

The system that I would now propose, founded on these principles, is as follows:

1st. The language is to be learnt through the medium of the English character.

The object of this is to get rid of any thing which is not absolutely necessary to be learnt at first.

It may be said that it takes a very little time to learn the Native character; and so it does to learn it *in a certain way*, that is, so that by fixing the thoughts upon a letter and taking a little time for consideration, it may be recollected to represent a certain sound, but it will be a long time before the character is so familiar as not to occupy the attention most seriously, and that at the time when there is the greatest demand upon it. But not only is a known character preferable at first on this account, but it is also superior as a medium to the Native character, as being less liable to lead to mistakes. In an Indian language for instance, in which

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there are two or three *n's* and as many *l's*, the beginner is always liable to forget which is which; but the plan of noting the sound by English letters with one or two dots under those that represent peculiar Native sounds, effectually prevents any such mistakes, the dots remind the reader in the readiest manner that they represent such sounds as are those upon which the attention should be especially concentrated. Every letter in the Native language must be represented by one certain letter of English, so that the proper spelling may be known. As to the learning of the Native character ultimately, if the student should require it, it is the easiest thing in the world when the language is known in other respects, and the whole attention is available for the letters only. The time required for this is most trifling but even were it considerable it would still be necessary to learn at first through the medium of the English character, on account of the enormous loss of time arising from having the attention overburthened at first. I therefore reject the Native character as being,

1st. Quite unnecessary for learning the language.

2nd. As being a most serious hindrance, absorbing a great deal of the attention, when its utmost efforts are required for those things which are essential.

3rd. As not being required at all by a great proportion of those who need to acquire a foreign language.

4th. As a thing that can be acquired with a hundredth part of the time which would be consumed at first, after the other parts of the study have been matured.

5th. As being more liable to be mistaken by the beginner than the English character.

If it be said, but how can it be avoided when there are no elementary books of the language in the English character? I answer, First, that I am here proposing a new system, and of course would have books prepared suitable to it; Second, that in many languages, as in those of Bengal, many books have already been prepared in this way; Third, that in many situations the student could, with the assistance of a Native, easily provide himself with the first ele-

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mentary books, without much loss of time, and certainly with much less expenditure of time, than by studying in the common ways with such books as are already provided; and Fourthly, that if there is no alternative, we must of course begin by learning the Native character, but still if we follow out the other parts of the system here proposed, it will be much less a hindrance to him than to those who adopt the usual means, because he will seldom have to read any words but those which he knows, and then the strange character is comparatively a small hindrance. Of course, in applying the English character, the value of each letter must first be defined, as is now fully recognized as an essential principle, and which is always acted upon in the Bengal books. The letter, *A*, for instance, has in English seven distinct sounds as in the words, *hat, mast, all, many, America, Yacht, make.* In all the East Indian languages, the letter which represents the sound of our *A*, in *Mast* or long *A*, somewhat modified, represents the sound of our A in *amuse,* or short *A*, and therefore this letter, with and without a long mark over it, should represent these two sounds and be used whenever the corresponding characters are used or implied in the foreign word. With respect to the other sounds of it, some are unknown in certain languages, as for instance the sounds of that letter in the words *hat* and *Yacht* are unknown in any Asiatic language. No Native Indians can pronounce the words *hat* and *hot,* but are under the necessity of substituting some other vocal sound for them, till they have learnt the true pronunciation. The other sounds of it will of course be represented by those English vowels which more properly represent them, only taking care, to use the same letter to represent the long and short sound, distinguishing the former by a long mark over it. Thus the sound of *E* in *Hen,* and *Féte* which are properly the same sound pronounced long or short, are represented in the Indian languages by modifications of the same letter and should therefore both be represented by *E.* With respect to the sounds which are either unknown in English, or not represented by any one English letter, they should either be represented by a combination of English letters, if possible, or if not by a letter or letters, distinguished by a mark; as for instance one or more dots under them. There are, for instance, four let-

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ters that represent in the Tamil language the sound of our *N*, or some modification of it; one, is precisely the sound of it, the tongue being placed in the same position as by us. This will be represented of course by our *N*. The second is the same in sound, though represented by a different character, but it occurs only when preceding and combined with a certain other consonant, this may also be represented by a simple English *N*, as the sound is the same. The third has the sound of *Ny* in English and therefore should be represented by those consonants, the sound is that of our *N*, in *New*. The fourth is a sound unknown in English: it is pronounced by the tongue being turned entirely back, so that the under part of its tip touches the roof of the mouth. An *N*, sounded with the tongue in this position is the sound required. This therefore should be represented by an *N*, with a dot under it, the dot or dots being the invariable mark of a sound quite strange to an Englishman, so as to be the readiest warning to the student that the tongue must be placed in a position which is new to him. This is much preferable to the Native character itself, because there can be no mistake about it without any effort of memory, whereas the foreign character will always require the student to consider which of the several sounds of *N* it represents.

It may be observed here, that, in general, probably in all cases, the languages of semi-civilized people that are written, have an invariable sound for each character, so that there is no such difficulty in representing them by the English characters as there would be in representing English by some foreign character, on account of the vocal sounds being represented in different words by different vowels; as, *Hat, yacht, many, all, &c.,* and *grief, leaf, seed, previous, Marine, receive, and homœopathy.* In writing English therefore in a foreign character, there would be no alternative but to use a certain letter for each sound, however that sound is represented in English writing, and correct English spelling must be learnt afterwards. But these difficulties do not exist in applying the English character to represent the sounds of most of the written languages of semi-civilized nations.

2nd. Begin with a restricted vocabulary. In the first place,

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reject of course all words which will never be required, such as those used only in learned works : next, reject all those that hardly ever occur even in books. Next let alone those that are chiefly in use only in certain particular lines of life, and are more or less technical. Again, have nothing to do with any words that are not commonly used in the ordinary matters of life. What can be gained but clear loss by burthening the young beginner with a multitude of words, by far the greater part of those in the language, that will be thus rejected, when they have nothing whatever to do with his acquiring a useful knowledge of the language, and when, if required, they can afterwards be added in a tenth part of the time that they would require at first. Probably out of twenty thousand words in a language, the knowledge of 5,000 would set him so perfectly at liberty in all ordinary conversation that neither he himself nor those he converses with would be reminded that he does not know all. And if occasionally a person used one of the remaining words, probably he could not mistake the meaning of it in the midst of so many known ones. And if he could not perceive what it must mean, he could have no difficulty in asking the meaning or understanding the explanation. Having thus relieved our student from such a mass of useless labor, let us next divide these 5,000 words, or whatever the number is, into several portions, taking out first one thousand and then another of the least common and least immediately necessary words, till we have only a thousand left. Out of these we again take 250 three times and then 150 in the same way, so that to begin we have only 100 of the commonest words in the language, but consisting of all the different parts of speech so that little sentences may be formed out of them. The learner then deals with only one of these batches of words at a time, not troubling himself with the others till he knows the first batch as well as he does so many words of his own language. This is one of the great essentials of the system proposed. Words should never be partially learnt and forgotten again, nor imperfectly, that is, so that their true value and use are not thoroughly known. When once a word is taken up, it should of course be thoroughly secured both as respects the meaning of it and its use, and it must

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be particularly observed that it is not the bare knowledge of a word that is wanted, so that a person by more or less thought can recall it to his mind, it must, to be of any use in conversation, be perfectly familiar, and it must have been repeated aloud so many times that the organs of speech have been thoroughly exercised in it, and that it may be pronounced both correctly and with the utmost freedom. Nothing but *multiplied repetitions of it aloud with continued reference to a correct standard, and in connection with various other words can accomplish this.* It must take some time thus to appropriate new words, and especially the first 100 words of a language, but the process cannot possibly be hastened, but on the contrary indefinitely delayed, by attempting thousands of others before the first are secured.

The number 100 is chosen for the first batch, as being about the smallest number that can enable one to make up some variety of short sentences, so that each word may be seen in a variety of situations and in its various inflections; and they are sufficient to provide for exercising the student in the first rudiments of grammar.

3rd. To each of these batches of words a set of sentences is to be added ; these are all to be the commonest colloquial expressions. They should consist of a certain number written on each word in the batch, and contain no words that are not in it. It is essential that they should be written by Natives, and those who cannot speak English would be preferable, in order that there may be a security for the sentences being true Native expressions. It is also essential that the writers should not be highly educated men, but ordinary intelligent men of the middle classes, otherwise the sentences would be almost sure to be full of fanciful things. The list of words should be given to several different persons in order to secure a good variety of expressions, and some selection should be made. The first set ought not to consist of less than 1,000 sentences, that is 10 to each word, in order that by means of this batch of words the first rudiments of grammar may be quite familiar, and some considerable notion obtained of the general style of expression peculiar to the language, keeping throughout the grand object in view, which is to arrange that, so far as pos-

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sible, the attention may be concentrated on one thing at a time. When a hundred words have been acquired, all the use possible should be made of them as the vehicle for conveying instruction in other respects before the attention is encumbered by new words, in order that when new words *are* taken in hand the student may have his attention in a great measure released from the pressure of the elementary points of grammar, peculiar style of expression, &c.

It is also most essential that these sentences should consist of only two or three words, never more than the latter. It is astonishing how very little new matter overloads the attention of a beginner, and the utmost care is necessary that no more should ever be placed before him at a time than that he can receive a distinct impression of it. A sentence of four or five words is quite too much at first, and nothing is gained by attempting more than the student is equal to. Comparatively speaking, a very considerable time must be given to the first set of sentences, for there is a great deal to be learnt by them.

It is evident that they involve almost all the pronunciation, the inflexions of the nouns and verbs, the mode of combining the different parts of speech, the exercise of the organs of speech and that of the ear on the sound of the language, &c.

The first progress of a student in a new language, at least in one entirely dissimilar to his native tongue, is indeed astonishingly slow, and it is of no use attempting to push him on faster than he can go. We constantly meet with what are called, easy books for beginners, but probably there is not one published in any language that is a hundredth part easy enough or that does not seem to suppose a progress at first a hundred times more rapid than any student makes.

The sentences must of course be translated into English, but it is essential that they should not be written originally in English and then translated into the foreign language.

We do not want to teach a man to speak English sentences in foreign words, but to use the foreign expressions.

The second set of words consisting of 150 may perhaps contain ten sentences for each word, or 1,500 in all.

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These may be a little longer than the first, as the student will be able to obtain a clear impression of a greater number of words together, but probably they should not exceed five. After this, the sets of sentences may consist of fewer upon each word, and perhaps only one upon each of the last two batches, and they may be lengthened gradually, the last being of any length.

The essential points of these sentences are therefore,

First, that they should be bonâ fide expressions commonly used in the language, and consequently that they should be originally written in the language by a Native. 2nd, That they should be simple, ordinary, colloquial expressions, and therefore that they should not be written by learned men who would probably spoil them. 3rd, That they should be extremely short, the first set not exceeding three words, and the others very gradually lengthened. 4th, That there should be a large number of them in the first set of words, so as to make as much use as possible of those words before proceeding to new ones. 5th, That there should be as great a variety of expressions in the sentences as possible.

In printing the sentences there should be, first, the Native words separately and in the proper character: 2nd, Under each of them the same word in the English character: 3rd, The most exact English meaning of each individual word; and 4th, The full power of the sentence freely given in English.

The use of the Native character is, to enable a Native to teach from the book, who does not know English.

As one great point in preparing these materials is, to provide for a person having to learn the language, with the help of Natives who do not understand English, or who are not thoroughly qualified teachers, it is desirable if possible that these sentences should have numerous notes subjoined, giving all the information that can be suggested by each sentence and that can in any way help to give the student an intelligent knowledge of the language. These notes should, if possible, be written by an intelligent Englishman, who will know from his own experience what misapprehensions beginners are liable to form on account of their English

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ideas, and what points are likely to be difficulties to them. If the first two sets of words had ten sentences in each, and the last thousand words four on each, the whole of the sentences, on, suppose, 2,000 words would amount to about 10,000 which would be sufficient to make the student thoroughly at home in expressing himself freely on all common subjects. Besides these general words and sentences, each student, according to his profession, ought to have a separate set of words and expressions belonging to his peculiar occupations, whether those of a Magistrate, a Merchant, a Missionary, an Engineer, &c.

But it would be of no use his acquiring this information till he was in some good measure grounded in the more general use of the language, and therefore he should not perhaps take such a list of words in hand till he had gone through the first two thousand general words with their sentences. The professional sentences should contain, of course, only those words already learnt in addition to the technical words. With these sets of words and sentences there should be a short grammar, containing only the first rudiments, in the simplest possible form, so that it can be referred to without loss of time on any point. This however in fact should be made comparatively very little use of. Rules of grammar are not wanted, a man in conversation cannot possibly stop to form the participle of a verb from the root, by considering the rules. If it does not come of itself into his mouth nothing can make amends for that defect. What is wanted is, such a knowledge of grammar as a child of four years old possesses; that is, a knowledge which enables him to speak correctly, intelligibly, and without hesitation, though he does not know a single rule for anything he says. His speaking *must* be independent of any rules, whether he has learnt any or not. Yet a short grammar, to be looked into occasionally, at first may be of some little assistance in acquiring the inflexions of the nouns and verbs, &c. But the grand means of acquiring a grammatical use of the language must be simply the repetition multiplied, of a good variety of correct forms of expression.

Nothing can be more absurd than insisting upon knowing the rules of grammar before a student can be allowed to know a language.

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If a man talks English grammatically, that is, correctly, he is never examined as to whether he knows any rules; perhaps he never learnt a line of any English grammar, but it makes no difference. But it is always expected that a man studying a foreign language should be able to stand an examination of a kind neither he nor his examiner could stand in his mother tongue. The same man who meets a stranger in the street and knows well by the first sentence that he utters whether he is perfectly acquainted with English or not, is perhaps on his way to some place where he will pass hours in ascertaining whether a student has a good knowledge of a language foreign to him.

These are therefore the materials which I would put into any man's hands, who wants to study a foreign language for colloquial purposes: viz., a vocabulary of perhaps 2,000 words, divided into sets of, from 100 to 250, with about ten thousand common forms of expression, composed only of each set of words and those words previously learnt. These printed both in the Native and English character, with a verbal and a free translation, the sentences to be aided if possible by copious notes giving all the collateral information possible; and to these to be added a very short rudimental grammar.

It will not perhaps be necessary to give the verbal translations of any but the first 2 or 3000 sentences.

As to the student's further study, he may of course now with perfect ease follow the ordinary plan; that is, take up any book that contains the sort of words and matter most suited to his line of life, with an ordinary dictionary and grammar to which however he will have very seldom to refer. He will know so large a proportion of the words that the context will generally show the meaning of any new word he meets with, and he will lose very little of his time in that which usually occupies about three-fourths of all the time expended in such studies, viz., in turning over the leaves of a large dictionary and guessing which of the several meanings there found for a word is compatible with those of the other words of the sentence before him, many of which he has also yet to ascer-

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tain. But his great business should of course be to converse as constantly as possible in order further to exercise his tongue and his ear, and to add to his stock of forms of expression. It is to be remembered that, in using books, a principal exercise should be, reading aloud and having them read aloud to him by a Native.

If his occupation will require formal writing or translating, of course he must exercise himself a good deal with books. It is well known that the most easy and certain way of acquiring a correct and easy style in writing in any foreign language is to make or procure accurate translations of Native books, and then re-translate them, comparing such re-translation with the original and thoroughly considering the difference between them. This can be done with the greatest ease and economy of time when such a good fundamental knowledge has been acquired as is supposed to be obtained through the system now proposed.

The next point to be considered is the mode of using these materials.

The student begins with the English letters representing the sounds. The teacher sounds each letter and the student repeats it immediately after. This is done many times with those letters which represent sounds entirely strange to the learner. The most essential thing is to learn where to place the tongue in these last sounds, without doing which it is impossible he should utter them correctly; and this must be most patiently and diligently practised, because this new motion of the tongue must be acquired to the same degree of facility as he has in pronouncing the sounds of his own language. This cannot possibly be effected except by long continued use of the organs of speech. At first, each of these letters should be pronounced perhaps ten times over by the teacher, and repeated by the student instantly, the latter always observing carefully the difference between his own pronunciation and that of the teacher's, which immediately follows.

The grand means to attain to a correct pronunciation must always be thus for the learner to attempt it both immediately after, and immediately before, hearing it correctly pronounced by a Native. Just as in learning to write it is not sufficient first to look

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at the original and then try to imitate it, but after writing it to look again at the original to see in what respect the copy has failed. Of course it will only be necessary to do this with the new sounds, which will generally be only very few.

The student next takes the first list of 100 words, which are all written in the shortest form, that is, the radical form of the verb, &c., as we should write in English, *good*, *go*, *little*, *come*, *&c.* The teacher should then pronounce the first word deliberately and distinctly, and the student should repeat it, followed by the English meaning of it, when it should again be repeated by the teacher, and this suppose five times at first.

In this way the whole hundred words would be gone over many hundred times before the student ventures to attempt pronouncing them by himself. The teacher and student should sit at some distance apart, so that it may be necessary to speak pretty loud. In these first exercises the student should have the printed words before him, that he may have the assistance of sight in addition to that of hearing in impressing them on his memory. It will of course be at first tiresome to continue this exercise long, nevertheless the longer the better, and if a person could arrange to do it for one or two hours, at three or four different times in the day it would probably be best—but he should not attempt to learn them by heart because his pronunciation will not be sufficiently confirmed.

When he has become tolerably familiar with the words of the first set of sentences, both as to pronunciation and meaning, by thus repeating them with his teacher several times and with his book before him, he should put down his book and go over them again in the same way several times, without seeing the words, so as to be wholly dependent upon the ear. From the first, the ear must be exercised as far as possible without any aid from the eye. It must be kept continually in mind that the sight is to be used as little as possible for the reasons before given. The sentence should not be read together the first time of going over because the student is not yet able to receive any distinct impression from more than one word at a time. The student should not yet trouble him-

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self about the mode of framing the inflexions that he meets with, but be content to take the word with its exact English meaning as he finds it. In this way he should go through the first 1,000 sentences with his teacher which will perhaps take him 15 hours, or suppose three days' study, during which time he would have repeated every one of the first hundred words on an average about a hundred and fifty times, including the separate readings of the list of words.

Less than three times repetition of each word is not sufficient to ensure the students correcting himself when he pronounces it imperfectly the first time.

After the first and second reading of the sentences, repeating each word by word, the whole sentence should be repeated in the same way at least three times over, the student repeating the free English translation after the foreign sentence.

The readings should be repeated till every word has been heard and uttered suppose 600 times. During these readings the grammar of the nouns and verbs may be looked into a little ; and, lastly, the sentence should be learnt by heart. And when the student is well exercised in the pronunciation by these means, so that he can trust himself to utter it without first hearing it spoken, the sentence should be again gone over in the same way, but the teacher beginning by repeating first the English word, when the student gives the foreign one, the teacher immediately repeating it again and so on. But if it is found that the student cannot yet remember the word and pronounce it with perfect ease, they should be read over again in the former way. When able to do it, the whole set of sentences should be again gone through without the words being repeated individually, the teacher the first time giving the foreign sentence, and the next time giving first the English sentence.

It may be supposed that all this will not be necessary; and it certainly is not, in order to obtain such a knowledge as is usually supposed to be sufficient, that is, a knowledge which, when brought to the trial of conversation, is found to be of little or no use. But it will be found that, to obtain a really familiar acquaintance with this first set of words and their easy and correct pronunciation and use, these multiplied repetitions are absolutely necessary.

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Nothing but a long continued exercise of the ear and the organs of speech upon a great variety of actual expressions can give either that quickness at hearing and pronouncing, or that facility of correctly combining the words, which are essential to their effective colloquial use.

It must be particularly observed that this first set of sentences thus acquired implies much more than might appear from the first glance, namely, there is involved in it as it were the whole pronunciation of the language; for a man who can pronounce freely and correctly 100 words will have little difficulty in pronouncing all the rest: 2nd, a knowledge of all the inflexions of the nouns and verbs: 3rd, the mode of combining and arranging the different parts of speech.

Thus, though only 100 words are used, some real and considerable progress has already been made in the knowledge of the language.

This first set of sentences should not be laid aside till they are so perfectly familiar, that almost any one of them can be repeated with the utmost readiness, on the English translation being uttered. Nothing whatever will be gained by meddling with new materials till these first are thoroughly wrought into the student, and made as much part of himself as the words and expressions of his own language.

The second set of words and sentences must be read over and thoroughly appropriated in the same way as the first.

Probably these first 250 words with their sentences may be mastered in a month of steady study of 3 or 4 hours a day, and 750 additional words with about 3,000 longer sentences in another month, completing the first 1,000 words in two months. After the thorough grounding which this will give in every respect, in pronunciation, in expression, in hearing, in grammar, &c., the additions will be made with much greater rapidity.

Every thing depends upon this first grounding being through and complete. Nothing but such repetitions will accomplish this object—there is no other way of doing it.

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A soldier may be shown how to march, and he may be made to move his legs in the manner shown in a few steps, but nothing but long continued practice can possibly enable him to do it both correctly and with ease; and it is the same with the muscles of the tongue, the ear, and the brain, as it is with the limbs.

A girl may have the finest ear possible, but that will not enable her fingers to run over the notes of a piano or her throat to produce the notes of a song freely and correctly, without long exercise of those organs.

After the first month the teacher will be required much less, because the student can be trusted to pronounce when he is alone, provided he exercises with the teacher for some time daily. He should always read aloud by himself just as when he reads with the teacher, both because, the great point is the exercise of the organs of speech, and hearing, and also because the pronouncing of the word is so great a help to remember the meaning. It must however be remembered that in this solitary study as little use as possible should still be made of the eye. The word or sentence should be merely glanced at when necessary and the repetition should then be made without looking at the book.

With respect to the time required, I cannot speak certainly, because I have never had an opportunity of seeing the study commenced with such materials properly prepared beforehand; but so far as I have seen it tried with imperfect materials, the result was certainly excellent.

In the only case where an approach was made to a fair trial, a gentleman studied irregularly, but equal to about two months' continuous study of five hours a day, and from that time he went out and performed all his duties without an interpreter, having constantly to converse with the middling and lower classes, most of whom had never spoken to a European before.

This was a real, practical and effective acquaintance with the language, though within small limits as to his number of words and expressions at first starting; but then his ear and tongue having been well exercised, he could both make himself under-

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stood and he could recognize the words spoken to him, and consequently he was in a position to make steady progress in the correct use of the language from his intercourse with the people, and this he accordingly did. It would of course have been much better if he could have continued the same course of study, though it were only for an hour or two a day, by which he would have far more rapidly added to his stock of words and expressions.*

It is very probable that many persons would complete the appropriation of the first 1,000 words and their sentences in one month.

I would now only ask which is preferable as a foundation, such a really effective use of a language, though within small limits; or such a loose, vague, and useless knowledge of a vast number of words, with the rules of grammar, as is usually acquired after at least many months of hard study, during the whole of which time too, the attention has been kept in a very injurious state of tension by the overwhelming load of new things that has continually been laid upon it at one and the same time. I believe that in general little effective colloquial use of such a language is acquired within a year of hard study, and that often two or three years or more pass before the student can talk it tolerably, though only a portion of that time of course is actually employed in study. On one occasion, I was acquainted with two men who studied intensely (about ten hours a day) for nine months, after which upon trial they found that they could scarcely hold the slightest communication with Natives.

A remarkably apposite passage from the life of Dr. Hope may here be quoted which I have just met with, and in which a part of the very means here proposed are stated to have been used by him with the most remarkable success, though he did not begin upon this plan, but merely learnt the colloquial use of a language after

* An educated Native, who had, I believe, helped to teach this gentleman, lately told me that he had overheard Natives speaking of him, who said that if they had not seen him, they should not have known that it was not a Native who was speaking Teloogoo.

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he had acquired a considerable stock of words. He had already picked up a good knowledge of French and Italian, so far as mere reading went, and he imagined like many others that a little practice on the road would enable him to speak the language sufficiently to carry him through his tour; but it was a very different thing to hear the lessons of professors and to converse with the Natives of the country. Of this he found a very humiliating proof. He went to engage apartments at a private hotel, but after a pantomimic performance of twenty minutes between himself and the landlady, it was found that neither could in the slightest degree understand the other, and after laughter and reciprocal bows he returned in despair. Having settled at another hotel, he now determined to devote twelve hours a day to the mere practice of speaking French. His first step was to engage a French Master for twelve lessons, and to make him go through the drudgery of reading three words at a time, while he mimicked them as closely as he could. This was singularly disagreeable to the master, but it was all that Dr. Hope wanted and he was inflexible. He thus secured himself against any gross error in pronunciation. He happened to possess a Wanostrocht's grammar with a key to it, a grammar which is remarkable for the *great number* of *simple exercises* which illustrate each rule. He now translated these exercises from English to French, correcting himself by constant reference to the Key. In this way he went two or three times through the grammar in the course of a month *gaining flexibility of tongue* and losing the fear of hearing his own voice. He at the same time adopted another device; he went to dine daily at a small and crowded restaurant frequented by the Garde du corps, where the company was so closely packed that he could not help hearing the conversation of two or three contiguous talkers. In this way his ear got *familiarized with all the sounds of the French language*, whether quick or slow, correct or provincial. At the end of a month he ventured to sally forth, and, having a fancy for the rooms of the private hotel to which he had originally gone, he waited on the landlady. On entering he addressed her in fluent French, explained his wishes, &c., the landlady the meanwhile, with up-raised hands and a look of utter amazement, exclaiming, "Voilà un miracle! you cannot

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be the same gentleman that called here a month ago and could not speak a word of French."

This case has no reference to the principles here proposed, so far as the use of a restricted vocabulary is concerned, but it shows how perfectly ineffectual the knowledge of book language and the exercise of the eye was, for colloquial purposes, and how complete the success was both in respect of time and effect, when the means here proposed were used, viz., the thorough appropriation of a good stock of simple familiar sentences, and the diligent exercise of the ear and tongue.

He was totally without the colloquial use of the language, so that he could neither understand a word spoken nor speak one intelligibly when he began to adopt the means he did, and in one month he found himself perfectly at liberty in conversation.

In the same memoir it is afterwards related;—"Having had a lesson in France on the inconvenience of not being able to speak the language of a country in which one is travelling and studying, Dr. Hope guarded against a similar inconvenience in Italy. Before leaving Paris he improved his pronunciation of Italian by taking twelve lessons, as he had formerly done in French, and he provided himself with a brief practical Italian Grammar, with Exercises referring to the rules, and a key to them.

"During a tour in Switzerland it was agreed that he should walk in advance of his friend for an hour daily, to give him an opportunity of *practising these exercises viva voce.* This plan answered perfectly; at the end of the time he spoke Italian fluently."

It may perhaps help to show yet more distinctly how far the principles here advocated differ from or agree with some of the commonly received notions on the subject, if I place my views side by side with those lately advanced in an elementary book for helping the student of an Indian language.

The 1st principle laid down is, "Do not proceed too quickly. An entirely new language requires great accuracy in the mastering of its elements." In this I agree, but I consider the book itself implies a progress in the learner immeasurably beyond the reality.

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2nd, " Write down every thing from the beginning. Read always with pen or pencil in hand." This is directly opposed to two of my principles, one an essential one, the other, one of great importance. The first, that every thing is to be learnt through the ear, and not through the eye, because it is the ear that is to be employed in using the language and not the eye. The other, that the foreign character should not be used by the beginner, because time must be saved in learning one thing at a time, and the character is not necessary to enable one to learn the language itself.

3rd, " Read aloud all the exercises with a Tamil teacher, and be very careful in ascertaining the correctness of what you have written." Here it is evident that there was some sort of loose notion about the exercise of the *tongue,* but it also shows that there was nothing like a real apprehension of the essential importance of this, nor of the extent to which that exercise should be carried. Nor is any thing at all said about that which I insist upon, as the main point, viz., the impossibility of learning to pronounce correctly, and the certainty of being established in a false pronunciation, unless for some considerable time, no word is pronounced without referring at the time to a correct standard, without the student hearing one word at a time pronounced both immediately before and immediately after himself by a Native. As to the latter clause of this hint, I urge that the only possible way to secure the correctness of what one learns is not to attempt to invent anything, but to be content to learn every thing, every sound, every word, every expression from a Native.

4th, " At first, whenever you meet with a new word look for it in the vocabulary, and decline and conjugate it in full. My rule is, never meet with a new word, and never lose a minute in looking for a word in a vocabulary, or in *guessing* which of the different meanings that may be there given is the right one ; and never lose time in declining and conjugating a word in full. Use only limited lists of words, and thoroughly appropriate every one by hearing it applied in a great variety of short sentences, in the course of which exercises, the grammar will necessarily be picked up long before the pronunciation and value and use of the word

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are fully acquired. Yet it will be of some use to look occasionally into a short grammar containing the inflexions of words.

5th, "Begin to talk, though with stammering lips, as soon as possible, the very first day. Never speak English to a Native if you can help it. Why say *salt*, when you know the word, *Uppu?* Do not be afraid of making mistakes."

This rule contains the very essence of the ordinary system, or rather of the old notions. It is diametrically opposed to the universally acknowledged and universally applicable principle. "Whatever is habitual is easy." It is always easier to do a thing the second time than the first. My principle is, "Be afraid of one thing, making mistakes. Every time that a mistake is made, one step more is taken towards a confirmed habit of making that mistake. Why do men in talking English as their own language go on putting *h's* in the wrong places and leaving them out all their lives, in spite of their getting into a different class of society, where they continually hear the correct pronunciation in this respect, without ever being corrected? Because by habit their perceptions have been so blunted that they never perceive that they make a mistake. Do we not keep this principle of avoiding mistakes in view in almost all other cases excepting this? Do we set a child to make a rude imitation of some letter and then leave him to repeat it without a standard? or, do we insist upon his incessantly looking at a standard, and never making one written letter without trying to imitate that standard which is placed before his eyes?

My principle therefore is, never, attempt to guess at any thing, whether it is a sound, or word, or an expression. Take the most effective steps you can to prevent your ever "making a mistake." Is there not enough work to do to learn the real language, that you must take measures to oblige yourself to add to it the unlearning of your own mistakes? Every time you pronounce a word wrong you have that to unlearn, On no account therefore attempt to *speak* in the proper sense of that word till you are established in

1st. A sound pronunciation.

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2nd. In the knowledge of the true value of a stock of words.

3rd. In that of a good amount of Grammar.

4th. In that of a large stock of bonâ fide Native expressions.

Is not this principle undeniable? Does a drawing master tell his pupil, Go and make rude and absurd drawings of a hand or a foot, and then occupy yourself in unlearning the habit you have been acquiring, or does he set before his pupil a true representative of a thing, and say, Imitate this, with the most earnest and close attention and never make a line without referring to the standard? Which pupil would make the greatest progress and which would be most likely to attain to perfection in his study,—one who was always trying to make rude drawings of a foot out of his own imagination and then laboring to correct them, or one who did not attempt to invent at all, but kept exercising himself in imitating a correct representation of a foot.

6th "Be very careful in noting down differences in idiom between your own language and Tamil. If you hear much Christian or Cutcherry Tamil, beware of thinking all you hear to be really Tamil. Try to cultivate a Tamil ear, so as to detect an unidiomatic expression as you would a false note in music. You should *understand* all you hear; you need not *use* any expression that is not good Tamil."

I would only ask how a student can possibly learn to distinguish between true language and false, except by learning the true, and taking care as far as possible not to come in contact with false language, whether coming from himself or any body else, till he has acquired a sound taste and judgment, by a *confirmed* knowledge of the true language.

The simple rule is, *Learn* the true language, and then you will not waste your time in acquiring and trying to unlearn a false one. Sow clean wheat in your ground, and not wheat and weeds mixed together, and then you will not require to employ all the season in trying in vain to root out the weeds which you have yourself sown.

It is this sort of instructions, continually inserted in books of instruction in languages, and which are directly opposed to well

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known general principles, which show so plainly how entirely undigested the subject still is, and how people in general are still acting upon notions that they have never examined, and which will not bear the least examination.

In the book which is prefaced by these rules, the materials provided to assist the learner of Tamil are all prepared upon the usual false principles :—

1st. An unlimited vocabulary is used, so that every word must be learnt and forgotten a hundred times over.

2nd. All sorts of words are introduced, words perfectly useless to a beginner, words derived from Sanscrit and scarcely ever used in conversation, words used only in books translated from English by Englishmen, &c.

3rd. The sentences are certainly not all written by a Native, so that the learner takes up the book with the encouraging feeling that he does not know which are true Tamil sentences and which are not.

4th. Almost all the sentences are much too long for a beginner.

5th. Many of the sentences are such as it is quite useless for a beginner to learn.

6th. English sentences are given without the corresponding Tamil. How is the *learner* to discover what the proper Tamil would be unless he is told?

7th. The same with the Tamil sentences. What can be the use of leaving the *learner* to guess what the English meaning is, knowing that when he has guessed it, it may be either right or wrong. Suppose a Tamil man were learning English, how could he find out the expression we use when we ask who a certain person is? How could he ever guess the expression, *Who's that?* Or could he find out of himself these expressions, *What's the matter? Where has he been? Come away. I'd rather not. Never mind Whether or not. I can't help it.* You might as well set a man to guess, at the words of a language as at its common expressions.

When I put this book into a Moonshee's hand, the first thing he said, was, Many of these sentences are not common Tamil expressions, and many of the words are not commonly used in conversation.

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This might be said of almost any book, I suppose every book, of the kind. What is a learner to do who has no better materials? It is destructive for a learner to use a book, when he is not sure whether the sentences are Tamil or not.

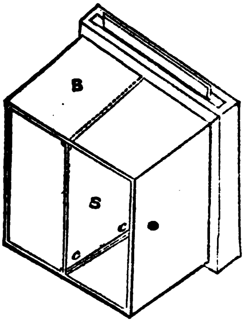
I mention these particulars of this book, as illustrative of the mistakes, and undigested ideas that are current on the subject.

X. *A mode of taking Stereoscopic Portraits with a common Camera. By Lieut.* L. PAXTON.

(Communicated to the Madras Photographic Society and by them to the Journal for publication).

Thinking it may be useful to Photographers who wish to take Portraits for the Stereoscope, but who have only a common Camera I send the plan of an addition by which this may be done.

As very nice work is not required, it may be made by an ordinary carpenter and at a very slight expense. The time taken to do both pictures is but little above that required for the two exposures. The back of the Camera B. remains unaltered with the exception of thin strips of wood *c. c.* which are attached to it to receive a thin screen S. which separates the pictures; the length of the screen depends on the focus of the Lenses. There should be as little interval between it and the exposing frame at one end, and the back line of the combination on the other as possible.



The front of the Camera required may be made of teak wood in

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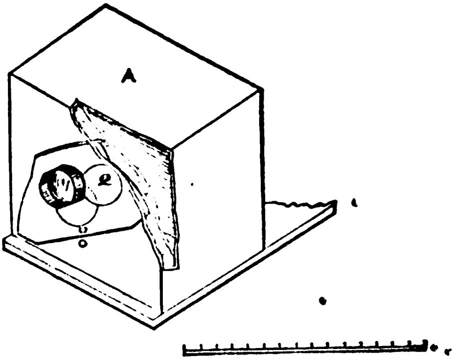
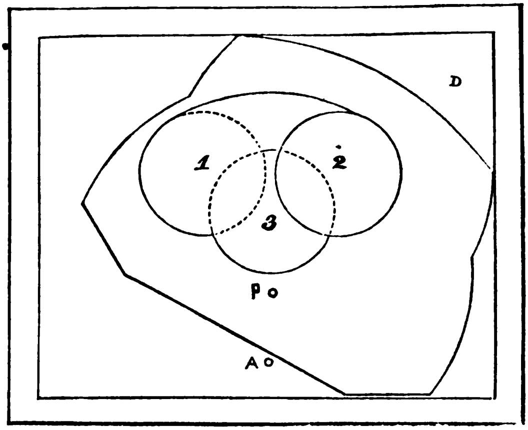
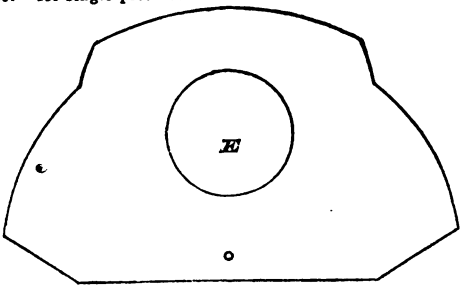


Scale of Inches.



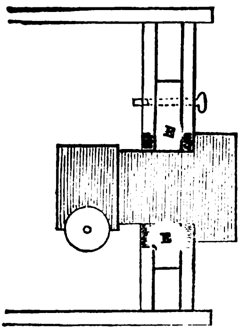
All parts of slider and front of Camera should be carefully blacked, the slider should move freely between the partitions, which should not however be too far spent so as to admit light.
P position of Pivot for Stereoscope pictures.
A do. for single pictures.

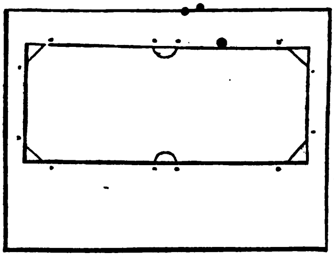


Slider half size.

the form represented in Figs. A. and D. the Lenses being merely fitted into the shifter E. as in the accompanying figure so as to render it unnecessary to injure the Original Camera by removing the screw ring.

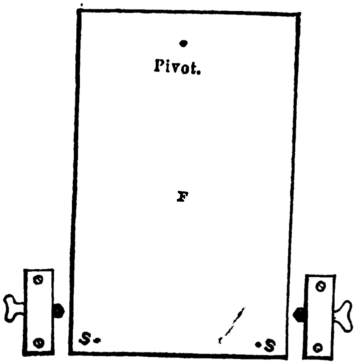
In taking a picture, the lens being at 1 Fig. A., the exposure for the first picture is made in that position, the lens is then closed and shifted to 2, the exposure made and the pictures are completed. After printing however, the pictures are in their wrong position and require to be





changed the right one becoming the left and *vice versâ.* Whilst for glass positives it is necessary to use separate glasses, the frame having a smaller central support as below. As the centre of the lenses in taking Stereoscopic pictures is a little above the centre of the Camera, the position of the glass plate must be made to correspond.

I do not observe that the glasses being parallel instead of converging towards the object makes any perceptible difference in the pictures, but when a table is used to support the Camera, such convergence might be easily given by having a pivot under the front of the Camera and limiting its lateral motion by screws placed as in the accompanying figure F.



SS two snipe shot which allow it to move easily.

I have found it impossible to get made here the rather complicated exposing frame usually described in books on taking Stereoscope pictures, when a system of parallel bars is used on a table to shift the Camera and at the same time to move the collodionized plate. With a Camera constructed as above the parallel frame might be used with advantage for groups of figures and distant objects, moving the object glass in a direction contrary to that given to the Camera, when the pictures would be in their correct places on the glass. I send enclosed a picture or two which will show that

the system answers,* though they are not very good specimens of Photography. Two of them are specimens of Hindoo carving in stone, the camera having been constructed a good deal with the idea of copying the curiosities in the many temples in this part of the country.

XI. *Report on a reputed* † *Coal Formation at Kota on the on the (Upper) Godavery River. By* PHILIP W. WALL, *Mineral Viewer at Madras.*

I have visited and examined the district around the village of Kota near the junction of the Pranheeta and Godavery rivers upon which reports have been made to Government of the probability of Coal being found beneath the surface there.

Although, in the report made by Dr. Walker in the year 1848 I could discover no positive evidence of the probability of the existence of a Coal formation in this district, I considered it desirable to provide myself with some means of making more than a mere superficial examination, of this particular locality, on account of the confidence with which opinions had been expressed, upon the subject, and that both Drs. Walker and Bell, whose examinations of the country must have been very extensive and minute, were led to expect satisfactory results from a search beneath the surface at this place.

Having seen in the Arsenal Stores at Madras, some light sets of Boring tools, (used for the trial of the ground for foundations of Public Works,) I applied for and obtained the use of two sets of

* We have examined these pictures and find them to be Stereoscopic.—A. J. S. SEC. PHOT. SOC.

† Vide Dr. Walker's report on boring for Coal at Kota, *page* 261, *Vol. I. No. II. N. S. of this Journal.*

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these;—in order to adapt them to my purpose it was necessary to make some few additions to them;—these I readily got constructed at the Government Workshop at Dowlaishweram, and also obtained from the officer in charge of that establishment, mechanics with other tools I considered it desirable should accompany me.

A detachment of seven Privates and one European Corporal of the Corps of Sappers and Miners who had been practising the use of the Boring tools in Dowlaishweram, were also by the kindness of the Commandant of Sappers placed at my disposal.

Thus equipped, my purpose was to reach Kota as expeditiously as possible, set my staff to commence boring at that place and proceed myself to examine the surrounding country.

By this means I hoped to get my boring party into working order at Kota and provided with such appliances, as I required from the district; and, in the event of my subsequent examination determining any particular spot where boring would be more desirable, I proposed removing my Plant and Staff from Kota to this place.

In the examination of the country I had proposed, I perceived much information was open to me in my march to Kota, if it could be undertaken along the course of the river. I obtained therefore the use of one of the Upper Godavery Paddle boats worked by six coolies; this I found of great service, it accompanied me to within a few miles of Aheree in the Nagpore country.

I left Dowlaishweram with my staff and materials on the 7th February, the Government Steamer *Pottinger* conveying us part of the distance to Buddrachellum, and arrived at Kota on the 13th of March, my camp with the tools, &c. arriving on the following day.

The great length of time occupied in thus performing a march of 240 miles was mainly owing to the difficulty with which I procured carriage for the materials. Government had provided me with one Elephant, and on further application had given orders for two more to join me, but unfortunately I only became aware of the difficulties of this nature in my way and made my application for these animals, a short time before my departure, they reached me therefore in time to be of service only on my return march.

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After leaving the Government Steamer, I sent my camp to march by land, and proceeded myself in a Paddle boat, taking only the road through the jungle occasionally.

My staff could have reached Kota in somewhat less time than they did, if it had not been impeded by the slow progress of the materials;—I had found it requisite to give instructions that the whole party should keep together as much as possible.

As for myself, I found it requisite to make my observations along the course of my march somewhat in detail and to visit every spot on either side of the river where the possibility of an opportunity of examining any exposed section of the rocks of the country might be presented, my own daily rate of progress could not therefore have been expedited.

The result of the observations in my journey was, that I had passed over a considerable extent both superficially and in thickness of a sedimentary deposit of sandstone and limestone, and at its edge or junction with some one or more great volcanic disturbances or faults, these had in fact formed the valley of the river, the channel forming a tolerably general line of division between the metamorphic range of hills on the eastern and sandstones &c. on the western side, occasional arms or branches of this metamorphic range, stretching across the line of the river and forming the great obstructions or barriers in its bed at Buddrachellum, Enchampilly and Aheree..

In the course of my examination of these sedimentary beds in my march up the river, I found nothing in the remotest degree approaching to those indications which are met with in European Coal districts, neither in my examination of the pebbles in the river bed did I discover any thing of this nature.

I could of course form no conclusion at all or be surprised at this negative evidence, as I was quite prepared to meet with a totally different state of circumstances connected with Coal districts in India to those of Europe, and that therefore an actual examination of the rocks in any district in detail through their entire thickness was necessary, in order to pronounce decidedly

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that the probabilities were against Coal being found in them or otherwise.

On my arrival at Kota, I found I was still in the same series of sedimentary rocks I had been passing over in my journey along the river, and was fortunately soon able to identify the limestone at Kota under which the Coal was presumed to exist, with the limestones I had observed at other places on the river, one of which was at a point 80 miles lower down.

This limestone although seen cropping out at several places on the river—at Yeytoor, a village, 2 miles below Chintagorem, at a point on the left bank opposite Pallemella, (Warrugoora,) and subsequently as I discovered at a place a little north of Kumalapetta, I had not been able to observe beyond a very small extent in thickness, I therefore proceeded on arriving at Kota to carry out my original intention to start my people to bore, and immediately selected a site upon this limestone which offered the best facility for carrying on the work.

A Sketch Map* showing the nature of the rocks and their inclination as indicated by an arrow pointed in the direction in which they dip is herewith appended, the dark blue line shows the outcropping of the limestone.

At Dowlaishwerum there are sedimentary deposits, consisting of a series of thin layers of very bright colored clays, above this a very irregularly stratified sandstone, of various degrees of hardness, a very small extent of this sandstone now remains in this district in isolated hills, it having been removed by the denuding action of water from the intervening valleys, its thickness does not seem to be very great about 50 to 60 feet, this and the underlying clays appear to be the result of the decay and washing of the volcanic hills lying to the north.

This character of formation extends to Rajahmundry.

Proceeding thence along the course of the Godavery, the banks consist of alluvial deposits until we reach Polaveram, we now enter

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* Vide Plate I.

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a volcanic country, syenite and other forms of granite with metamorphic rocks are only to be seen for a considerable distance. The river here passes through a narrow valley termed the Gorge, formed by an apparent fissure in the range of altered and volcanic rocks. This character of country continues till we reach Parnasala about 20 miles above Buddrachellum, with the exception of one spot, Riagoodum (right bank) 6 miles south of Buddrachellum, where the first appearance of a sedimentary deposit occurs. It consists of beds of sandstone very various in texture, deeply tinged with iron, and having veins of a harder sandstone, containing a larger percentage of iron traversing this mass in various directions. It is very uneven in its bed and much disturbed, the average dip is to N. W., in amount 20.°

Between Parnasala and Lingala we again have sedimentary beds, consisting of very coarse conglomorates and breccias, the latter containing angular fragments of limestone.

The course of the river is now for some distance entirely through a country formed of stratified rocks, the out-croppings of which are at frequent intervals to be seen projecting into the stream and on its banks.

These sedimentary beds extend into the country on the right bank only, on the left bank a range of hills composed of metamorphic rocks extend along the course of the stream. These consist of sandstones that have undergone various amounts of alteration in some places rendered only partially crystalline by the action of the volcanic heat, whilst in others their original character is entirely lost, generally they do not show any violent disturbance except at particular plaees, these are at Buddrachellum, Enchampilly and Aheree, and form the points of obstruction in the navigation of the stream. The stratified rocks seen on the right bank consist of series of sandstones in general character, resembling that already described as occurring at Riagoodum. They are occasionally much disturbed and contorted, in one place opposite Nargarum, they are standing vertical, the surface of beds being scored and polished by the attrition of the beds upon one another;—where however a general inclination of the beds is to be ascertained, it is to the W.

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occasionally a little to the S. of W. and sometimes to the N. of W., the direction of the river being N. W., at this part we are traversing in our course up the channel from the lower to the higher of the stratified rocks.

We continue in this upward direction in the series until we reach Yeytoor, where occur the uppermost beds I was able to examine. These consist of very uniformly stratified limestones 6 inches to 18 inches thick, the layers parted by soft clays and fibrous limestone, of these there were only visible above the water in the river 12 or 15 feet in thickness, above these occur beds of deep red marls, and variegated clays, their inclination is very small being about 5° only, and to the W. S. W.

From Yeytoor to Taicologodeen the course of the river leads us downwards, in the series again we pass over red and pink clays, and lastly to a white sandstone, at the latter place. Immediately after Taicologodeen we came into the metamorphic rocks forming the Enchampilly barrier.

After passing over about 12 miles of these, there occur near the village of Punkenna beds of limestone, very similar in external appearance to those seen at Yeytoor, they are in thickness from 12 to 18 inches and parted by thin seams of clay and fibrous limestone, their dip is to the N. E. about 5° to 10°,—at low states of the water in the river, they are seen on both banks, a considerable extent in superficial area being on the left, but owing to their low inclination a small amount only in thickness can be observed.

From this point to Nuggrum, we have frequent opportunities to observe the beds on both banks of the river, the general dip of them is N. E., the course of the river being N. W. we traverse along the strike of these beds somewhat however to the deep; we reach the lowermost beds on the right bank opposite Nuggrum; they consist almost entirely, of ferruginous sandstone, of various degree of coarseness and traversed by numerous veins of a harder description of the same material.

Between Punkenna and a point in the river opposite Mahadeopore, we get at very low states of the water in the river a small

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extent of mottled clays, these again outcropping at Sironcha where we have left the main stream of the Godavery for its tributary the Pranheeta, these are the immediate underlyers of the limestone beds at Punkenna as inferred from their relative position and their dip, and subsequently confirmed by the boring to be the case.

At Sironcha the Fort stands upon a hill, the side of which towards the river presents a steeply scarped face, and good section of these clays, they are here very hard, very various in colour from a deep red to a fine pink and grey, they dip to the N. E. or N. N. E. about 20°, they consist of layers of 3 to 6 feet in thickness, the lowermost layers being interstratified with the uppermost beds of the sandstone series beneath.

At Nuggrum, a well exposed section of this sandstone shows that the alternation with these clays has ceased, as also on the opposite bank of the river we have still lower beds of sandstone without clays.

Proceeding again up the river, the Sironcha clays are seen to continue for some little distance on the left bank, exposing beds above those at Sironcha, they assume a much deeper red colour here, on the right bank we have the sandstone occasionally appearing.

The limestone at Kota is the next rock to be seen, it has a N. E. dip of about 5°, the general inclination of the beds from the Enchampilly barrier to this point.

The banks of the river for some distance are now alluvial soil, until the villages of Annumpully and Sumpatum, here we have a whitish sandstone with a layer of red clay; in the bed of the river immediately above this point I observed lumps of limestone and red clay in appearance closely resembling the beds at Kota, the stone is not any where on the banks exposed in situ, but from the fragments found being large and angular, not worn at all on their edges their position is without a doubt at this place and outcrop only concealed by the water.

This is the last point in my observation along the river of the unaltered sedimentary rocks, those next exposed are metamorphic

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in character and continue to Aheree, the extremity of my journey in this direction.

Such was the information afforded in the course of my journey up the river; I had passed, in travelling from the Doomgoodiem to the Enchampully barriers, over a series of conglomerates and sandstones, and subsequently beds of limestone, having a tolerably uniform dip to the S. W. and from Enchampully westward, over what appeared to be the same series in an inverse order commencing with the limestone and having an inclination to the S. E. or in the opposite direction, all of these dipping towards an imaginary line or synclinal axis,—this line passes through a point midway between Yeytoor and Waragooroo, in a direction slightly to the westward of north.

That they were the same series was evident, from the order of superposition of the various beds, and from the fact of the identity of the limestone being clearly made out at two points, viz. at Yeytoor and at Kota, by the abundance of fish scales of the same character being found, at these two places.

In the town of Mahadeopore, a red sandstone is seen cropping out, with the same hard iron veins traversing it as in the neighbouring river bank, and still further to the S. W. about 3 miles from Mahadeopore, a small range of hills called Guntay Magoota, presents on its western side, a well exposed section of 200 to 300 feet in height. These beds are sandstone throughout in strata of 8 feet and upwards in thickness, the lower beds being very hard and compact: the upper beds as seen at the top of the hill, contain angular fragments of indurated clay, white or reddish in color or composed of thin layers, alternately white and reddish;—sandstone containing these fragments of clay, is to be seen near Nargarum, south of Yeytoor, it no doubt is the same bed, dipping from this place under the limestone to Guntay hills.

The beds at Guntay dip to the N. E. about 15° to 20°, they are much more uniform in the direction of their dip than on the river bank, where their close proximity to the line of the fault running

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along the eastern or Nagpore side from Buddrachellum, has caused them to be much disturbed in places, on this account it is very difficult to ascertain their general inclination either in amount or direction, and a large number of observations were requisite before this could even be surmised.

At Kota the beds of limestone dip at a very low angle and a very small amount in thickness of the beds can be observed ;—resting immediately upon them is alluvial soil, forming the river bank at this place : for some distance both up and down the stream, the nearest place where beds lying beneath those at Kota is to be seen is at Annaveram, one mile distant,—here a whitish sandstone crops out having also a N. E. dip ; by comparing the inclination of the strata at Kota and the distance between these two places,—I found the thickness of the intervening beds could not exceed much if at all 200 feet,—having started my boring, therefore, at Kota I determined to continue it there and examine as much as possible of these concealed strata, which I could nowhere,—either up or down the river, examine sufficiently in detail at the surface.

The boring was commenced on the 19th of March,—on the 6th of May, it had reached 111 feet in depth and come upon a bed of red sandstone ; this proved about 5 feet in thickness, and was succeeded by blue clay, and sandstone alternately ; we continued the boring until the 14th, when it had reached the depth of 145′ 8″ and was in a white sandstone much resembling that I had seen cropping out at Annaveram and which I concluded to be the same.

The boring was through 30 feet of very hard limestone beds, with partings of thin beds of shaly and fibrous limestone and clays, after which a series of hard calcareous clays and marls, variegated in color, or of decided blue or red, until the sandstone was reached ; no where did I perceive the slightest trace of Coal.

* A section of the ground as shown by this boring is appended.

Through the limestones and succeeding clays, our tools brought up frequently traces of the fish remains mentioned below.

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* Vide Plate II

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I was somewhat surprised I did not pass through in boring the bituminous shale alluded to by Dr. Walker in his report, upon examination of the beds in position above those I was boring through however, I found this substance interstratified with thin layers of sandstone about 1 inch thick, and layers of limestone, and at the same time quantities of the fish remains.*

Organic Remains. At Kota in the limestone beds, I found great abundance of fish scales, no doubt similar to those brought from this spot, by Drs. Walker and Bell, they proved of much value to me as identifying the beds at Yeytoor, where I also found them,—with those at Kota.

At Yeytoor, I also found impressions, answering the description given of the Crocodilian remains found by Dr. Bell.

At Sumpatum, in the white sandstone, the immediate underlyer of the marls and clays of the limestone series, there occur very large silicified trunks of trees, they are in considerable number and by the action of the water wearing away the enclosing sandstone, they are seen prominently projecting from the surface of the rock.

Near the same place and in this sandstone are a number of hemispherical calcareous projections in size from 12 to 18 inches diameter,—a sketch of one is appended.*

In the bed of the river in several places I found masses of Lignite, it is of a jet black color, and from its frequent occurrence has no doubt been instrumental in giving the reputation to the Godavery river, as being a coal producing district. It does not appear to exist in beds, but in isolated masses in the alluvium from which it is washed out by the action of the river.

One piece was inclosed in the sandy bed of the river, surrounded by heaps of large water worn pebbles, with which it could never have been transported on account of its extreme friability, the central portion is silicified and preserves apparently the structure of the original wood from which it has been converted, the outer coating is the lignite in various states of carbonization, part being brown

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* Vide Plate III.

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and preserving the original texture of the wood, and still even flexible, whilst other portions are completely converted to a substance having all the appearance of coal. The silicified nucleus is traversed by veins of iron pyrites. Great numbers of these silicified pieces of wood are met with, in every part of the bed of tne river.

In the Tal river, a small tributary of the Godavery, running into it near Lingala, I observed in my return journey,—the debris of a slaty coal, not in isolated masses, but thickly scattered over the river bed, it had been washed from its position in the banks or in some of the nullahs of this river.

It was unfortunate that this material did not come to my notice earlier; as it would have been very desirable to make some examination of the district, through which the Tal runs, the monsoon rains hovever had commenced on my arrival there and rendered an expedition into this unexplored district impracticable this season.

Mr. Tuke in his survey of the Sebbery river mentions the fact of a report that coal exists up that valley, as the Tal river runs into the same line of country that report seems to be confirmed in probability by the finding of the material in the Tal.

The line of fault, before alluded to, as observable along the whole course of the river has a tolerably general direction to the N. E., W. points of greatest disruption and alteration being observable at the Buddrachellum, Enchampilly and Aheree Barriers;—at these places the beds are turned up on end, and contorted in every possible manner,—at the intermediate places the whole masses of country seems to have been upheaved, the beds preserving a tolerably horizontal position; this feature is well observed in the hills south of Dewulmuree, where the strata can be traced running in horizontal lines from hill to hill, the intervening valleys having been formed by the washing away of portions of these beds;—towards the lower part of the river, at Kota and also at Albaka the beds have an inclination downwards from this line of fault, so that, in travelling in a north easterly direction from the river, a recurrence of the series described, or portion of it, may be expected to be again met with. I

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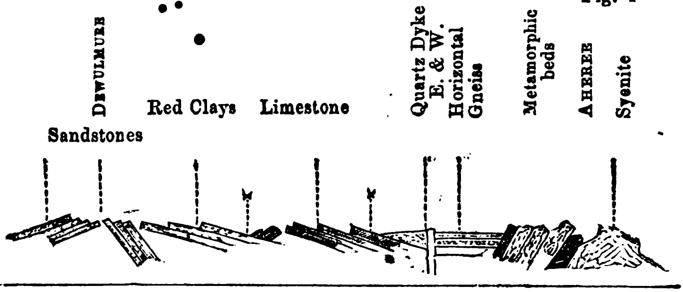
was informed by Dr. Jerdon who had just traversed this country that he had there seen ferruginous sandstone of great thickness, and also that it contained some thin seams of coal.

The river bed at Dewulmuree is entirely composedof altered rocks, inclined at a very high angle, amongst them the Kota limestone and its accompanying red clays can be clearly made out, also in the jungle path between Dĕwulmuree and Aheree, they are again seen much broken up and disturbed—(Fig. 1) is a section taken along this road.

Fig. 1



In the papers published in the transactions of the Geological Society* on the Geology of the neighbourhood of Nagpore, it is stated that the Godavery sandstones extend into the district around Nagpore, the series there detailed is ferruginous sandstone, laminated sandstone, clay shale and limestone, the limestone being the lowest in the order of superposition, according to this description the series at Nagpore can hardly be identical with that of the Godavery as it will be observed that the relative position of the sandstone, and limestone series is reversed at Kota, the limestone being uppermost. I observed in the hills above Kota to the N. E. or deep of the limestone, beds of sandstone, but I considered the evidence tolerably conclusive of their being upheaved and not overlying beds, being on the opposite side of the line of fault I have before alluded to, to that of the limstone.

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* In *Quarterly Journal, Vol. XI. Pt.* 3,

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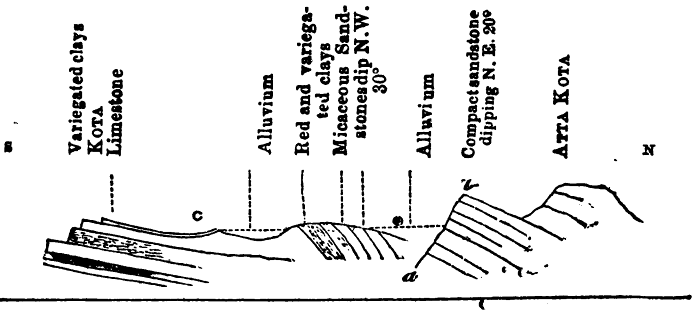
The following is a section of the beds as exposed along the river from the limestone at Kota northwards.



The sandstone at *a b* has a distinct cleavage structure running across the planes of stratification inclined 10° to the W. it is very close and compact, but still preserves its granular texture, the face *a b* is scored and polished, the beds seen at Atta Kota have the same dip but are less compact, this sandstone forms the range of hills to the north of Kota.

At C, the beds of limestone become horizontal and subsequently dip in an opposite direction to their general inclination, there is here a thin bed of laminated or micaceous sandstone.

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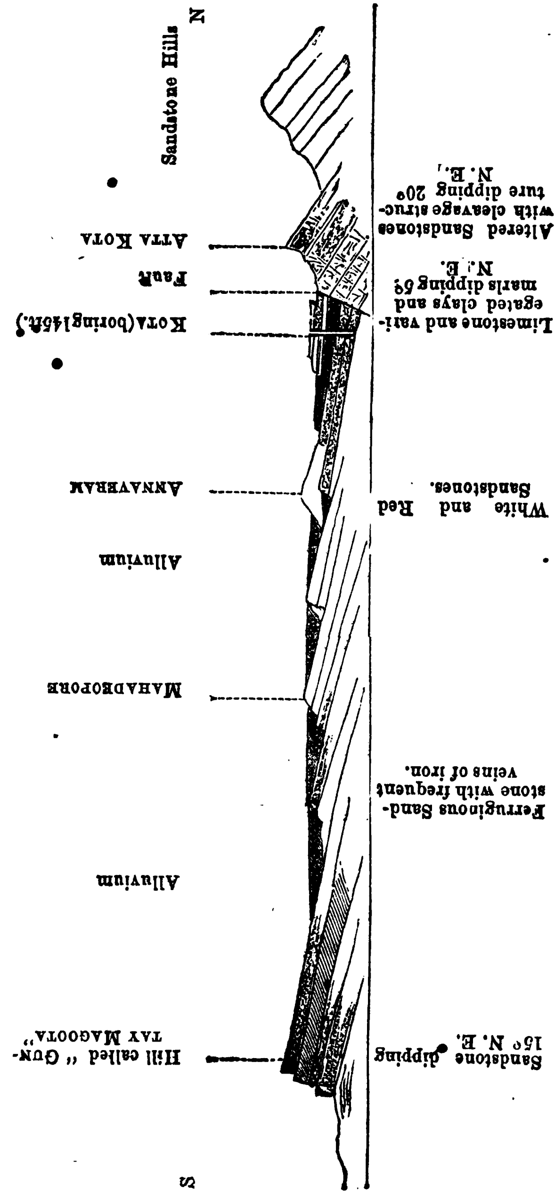
SECTION ACROSS THE VALLEY OF THE GODAVERY RIVER FROM MAHADEOPORE HILLS TO KOTA, LENGTH 20 MILES.



XII. *On the Oxymel process in Photography. By* J. Tawse, *Madras.*

My difficulties with Oxymel have been of two kinds, and which from what I have heard I believe are very generally met with in this country.

The first of these was rather humiliating in its nature. After a picture had been obtained sometimes at a considerable distance from my place of residence, on proceeding to wash the plate after the development the entire film of Collodion came away in sections leaving nothing but the bare glass. I was at first inclined to attribute this to a peculiar state of the Collodion, or to an acid bath which I was told was productive of this consequence. The Collodion used however was successively Hockin's, Thomas's, and Horne's, and my bath when I first commenced was perfectly neutral to test paper. It then occurred to me to roughen the margin of the plate not simply on the edges but on a space $\frac{1}{8}$ of an inch all round as has been recommended by Mr. Hardwich. This succeeded admirably, the film adhered perfectly during repeated and violent washings.

The second difficulty I experienced in the production of a negative picture was the want of intensity. I followed the details of Mr. Llewellen's process minutely, but in each case the result was a pale picture, showing ill as a positive and at the same time too weak to print. After repeated experiments I find that the remedy for this is as follows, I must first premise that the developing solution I use is the following:

Pyrogallic Acid	1	grain
Glacial Acetic Acid	20	ms.
Alcohol	10	„

As soon as the plate is taken out of the frame it is immersed for an instant in distilled water, and then placed on the levelling stand. A rapid washing so as merely to wet the film is all that is required,

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the small quantity of organic matter remaining on it tending to give density. The picture is then to be brought out in the usual way, but in this process I find that a large quantity of a 40 grain solution of Nitrate of silver is required before the image will appear, viz. about 5 or 6 drops to the drachm of the developing solution. The developer at this stage should not be applied further than is necessary to bring out all the details of the picture. When this is done I wash the plate well with common water and then treat with Cyanide of Potassium. The picture is now a bad positive and requires deepening. This is done by washing the Cyanide well off the plate, and then again carrying on the development with Pyrogallic Acid and Nitrate of silver, rocking the plate to and fro to make it flow evenly over its surface. The high lights immediately deepen into beautiful blacks, while the dark shadows should remain clear and free from any deposit of Metallic silver.

In my first experiments with Oxymel, I developed at once before fixing, and invariably got a certain degree of foggyness in the dark shadows which whitened them to such an extent that they were almost opaque and required a long exposure to print on paper. Two of the negatives produced at the last meeting were of this character.

The process is extremely easy in all its details. The following formulæ are I find the best in this climate.

Bath.

Distilled Water.................. 1 oz.

Crystallised Nitrate of Silver..... 30 grains.

saturated with Iodide of Silver in the usual way. The proportion of Iodide of Potassium I have used for this purpose is 5 grains to 20 oz. of the silver solution. After filteration I add to every 20 oz. of the Bath 10 minims of glacial Acetic Acid. This I find tends to preserve the clearness of the pictures under the developer.

The Collodion must of course be what is commonly used for negatives.

In this process many failures are due to the bad quality of Oxy-

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mel used. It is frequently very dark in color owing to the large quantity of wax always present in inferior honey.

After the plate has been washed for a little in distilled water after being excited in the bath, it is to be plunged into a flat dish containing enough of the Oxymel bath to cover it. This bath is prepared as follows, and may be used repeatedly.

Oxymel................	1 oz.	Filter.
Distilled Water..........	4 ,,	

The plate is left in this bath for a minute and is then well drained before being placed in the Camera frame. The plates will keep perfectly well for a week in this climate even during hot weather.

The exposure is long, viz. with a Ross' 4 inch landscape lens and ½ in diaphram as much as 9 or 10 minutes will be needed to bring out dense foliage. But this process has one advantage over others on Collodion, viz. that provided a sufficient length of exposure has been given, no ill effects follow from over exposure, as the picture seems to correct itself in the development, fogging being prevented by care being taken not to carry the first development too far.

The picture is then washed and dried in the usual way, and finally varnished.

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SELECTIONS.

Thwaites' New Cinghalese Plants.

No. II.

On TETRACRYPTA *and* KOKOONA, *Genera of Ceylon Plants; by* G. H. K. THWAITES, ESQ., *Superintendent of the Royal Botanic Gardens, Peradenia, Ceylon.*

(With two Plates, TAB. IV. V.)

I. TETRACRYPTA, *Gard. et Champ.* Nat. Ord. Hamamelideæ? (*Anisophyllea,* Br.; *Anisophyllum,* Don.)

Tetracrypta *cinnamomoides,* Gard. et Champ. *in Hook. Journ. Bot. et Kew Garden Misc. v.* 1. *p.* 314*. Anisophyllum Zeylanicum, *Benth. in Niger Flora, p.* 342, *et Appendix, p.* 575. TAB. IV.

HAB. Mountains of the Central and Western Provinces of Ceylon; alt. 3000 ped. Herb. Hort. Bot. Reg. Perad. n. 2205. Nom vern. "*Wellepeyenna.*"

Arbor ramosa 40-50-pedalis, cortice lævi. *Rami* inferiores horizontales, superiores suberecti; ramulis appresse puberulis. *Folia* disticha, coriacea, breve petiolata, lanceolata, cordato-acuminata,

* The generic name has occasioned a great deal of confusion. Brown first proposed the genus, for a West African species that yields a large edible fruit (in Hort. Soc. Trans. vol. v. p. 446), under the name of *Anisophyllea,* but gave no description. Don, in his West African collections, applied the name *Anisophyllum,* Don, MSS., to the same plant. Mr. Bentham, in the Niger Flora, took up Don's name for the West African plant, referred it doubtfully to *Rhizophoreæ,* and added in a note a description of the Ceylon species drawn up from Mr. Walker's specimens. In the same year, or perhaps the previous year, Gardner and Champion published *Tetracrypta* in the 'Madras Journal of Science' we believe, and subsequently in the Kew Garden Miscellany, and referred it to *Hamamelideæ.* In the supplement to the Niger Flora Mr. Bentham points this out, and states that the name *Anisophyllea* of Brown has the priority.

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basi angustata, 5-nervia, utrinque glaberrima; juniora rubra; paria vernatione opposita dissimilia squamæformia, unico 5-nervi marginibus involutis demum explanato foliaceo, altero 1-nervi plano stipulam referente cito deciduo. *Racemi* supra-axillares, solitarii v. gemini, strigoso-puberuli. *Flores* parvi, subsessiles, bracteati. *Bracteæ* minutæ. *Calycis limbus* superus, 4-fidus, lobis acutis, valvulis persistentibus. *Petala* minuta, carnosula, laciniata, æstivatione induplicativa, segmentis 5 linearibus subulatis. *Stamina* 8, alterna breviora, filamentis subulatis calyce insertis; antheris versatilibus longitudinaliter dehiscentibus. *Styli* 4, erecti, conico-subulati; stigmatibus capitatis. *Ovarium* 4-loculare; loculis 1-ovulatis; ovulis pendulis anatropis. *Fructus* indehiscens, abortu 1-spermus. *Semen* pendulum, albuminosum?

This is a handsome tree, 40 feet and upwards in height: its *wood* is very hard and valued by the Cinghalese for building purposes. *Young stems* and *leaves* downy, of a bright-red colour. The dissimilarity in the pairs of young leaves is very remarkable, one being flat, single-nerved, and soon falling away, whilst the other is five-nerved, has involute margins, grows rapidly, and is carried up by the elongating stem to some distance above the smaller one. *Old leaves* coriaceous, distichous, alternate, shortly petioled, 3-4 inches long, 1 inch broad, lanceolate, tapering to a long narrow blunt point: nerves five, strong, parallel. *Racemes* single or in pairs from the upper part of a large scar, which extends upwards from the axil of the leaf, pendulous or nodding, 1-1½ inch long, pubescent, eight-to twelve-flowered. *Flowers* nearly sessile, with small bracts, white, 1 line long, pubescent. *Calyx* of four valvate coriaceous green lobes. *Corolla* of as many small incurved white petals, seated on the calyx, split below the middle into subulate laciniæ. *Stamens* eight, alternately longer and short; filaments subulate; anthers versatile; pollen minute, elliptical, with a dark

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Under these circumstances we have thought it desirable to retain the name *Tetracrypta*, both because it was accompanied with the first published account of the genus, and because it was the only one to which Mr. Thwaites appears to have had access.

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central line. *Ovary* inferior, four-celled, with four erect styles and small capitate stigmas; cells with one anatropous ovule, pendulous from the summit of each. *Fruit* coriaceous, grooved, elliptical-ovate, with a narrow top and persistent calyx, one-celled, with one pendulous seed, which has only been collected unripe, but appears to be albuminous and to have an axile embryo.

PLATE IV. Fig. 1, 2. Very young leaves and stipules in vernation. 3. Flower. 4. Vertical section of the same. 5. Petal. 6. Stamens. 7. Transverse section of ovary. 8. Branch and nearly ripe fruit. 9. Vertical section of immature fruit. 10. Ditto of nearly ripe fruit.—*all but fig.* 8 *and* 10 *magnified.*

II. KOKOONA, *Thw.*, gen. nov. Nat. Ord. Hippocrateaceæ.

Gen. Char. Calyx brevis, persistens, margine 5-lobo. *Petala* 5, æstivatione contorta, firma, concava, glanduloso-punctata, decidua. *Stamina* 5, petalis alterna; filamentis basi disco glanduloso immersis; antheris oblongis, introrsis, longitudinaliter dehiscentibus. *Ovarium* disco immersum, 3-loculare, loculis 4-ovulatis; ovulis biserialibus, adscendentibus, anatropis. *Stylo* brevi, conico; stigmate capitato, 3-lobo. *Capsula* 3-locularis, loculis 4-spermis. *Semina* late alata, exalbuminosa, erecta; embryone orthotropo, cotyledonibus planis, radicula infera.—Arbor *ingens, ramosa, cortice rugoso.* Folia *opposita, petiolata, obovata vel retusa, versus petiolum angustata, obscure remote crenulata, lævia, coriacea, subtus minute glanduloso-punctata, stipulata.* Stipulæ *minutæ, coloratæ, acutæ, subpersistentes.* Inflorescentia *paniculata, axillaris.* Bracteæ *minutæ.* Flores *pedicellati, læves.*

Kokoona *Zeylanica*, Thw. TAB. V.

HAB. Central provinces of Ceylon, Ambagamowa district; elev. 4000 feet. Herb. Hort. Reg. Bot. Peradeniensis, No. 2584.

A large forest-tree, 60 feet or upwards in height, much branched especially towards the top. *Bark* rough, when cut of a yellow colour, somewhat corky. *Leaves* dark green, smooth, underneath paler, with very numerous minute dark red glandular dots. *Stipules* very minute, deep red, subpersistent. *Panicles* axillary, raceme-like. *Bracts* very minute, acute. *Flowers* dull yellowish-

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brown. *Calyx* minute, with five shallow lobes, persistent. *Petals* five, concave, firm in texture, with minute pale glandular dots on the inner surface, twisted in æstivation. *Stamens* five, alternate with the petals, inserted into depressions of the dark green angular disc. *Ovary* three-celled, each cell with four ascending anatropal ovules. *Style* short. *Stigma* capitate, somewhat three-lobed. *Capsule* 1·4 inches long, oblong, bluntly triangular, three-valved, three celled. *Seeds* imbricated, winged, erect, exalbuminous. *Wing* very broad, oblong, truncate or blunt. *Embryo* orthotropal; cotyledons flat.

In habit and general appearance this plant resembles the *Celastraceæ*, though it would seem to differ almost as much from members of that natural family as do the *Hippocrateaceæ*, from all the genera of which latter Order it differs in having five stamens.

The yellow bark is sold in the bazaars, and when pounded is used by the Cinghalese as a kind of cephalic snuff, being mixed with ghee and introduced into the nostrils in order to relieve severe headache, by encouraging a copious secretion from the nose.

The native name of the tree is *Kokoon*, which has suggested the generic name.

Plate V. Fig. 1. Flower. 2. Stamen. 3. Ovary and disc cut longitudinally. 4. Transverse section of the same. 5. Small, immature capsule. 6. Transverse section of the same. 7. 8. Seeds. 9. Branch and stipules:—*all but fig.* 5 *and* 6 *magnified.—Kew Miscel. Vol. V. p.* 378.

Aska Sugar Factory.

My visit to Aska has enabled me to gain much information regarding the manufacture of sugar, while my tour through the country has admitted of my following up an enquiry I begun in Rajahmundry as to the profits from its cultivation. The result of my observations is a conviction that it is, to the interest of Government to encourage the growth of this article to the utmost, and if that is done I am confident that it will become the great crop of

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the whole District of Ganjam, yielding, as it will, a profit far exceeding that from any of its other products.

The Aska factory has been raised to its present state of perfection by the most indefatigable energy, through many years of difficulty and loss. It is now in very high order and capable of manufacturing more than 12,000 tons annually, a very much greater quantity of sugar than the District yields at present, and the difficulty it has now to contend against, is the deficiency of supply. If my information is correct, the whole extent of land cultivated with sugar in the District is between 3' and 4,000 acres, which with a fair allowance for loss, occasioned by insufficient means of irrigation, floods, and other accidents, does not yield more than 4,50,000 pots of Goor; sufficient for the manufacture of about 4,500 tons of the fine yellow sugar exported.

The Aska works have not the command even of this supply; there is not only a considerable home consumption, but there is a great demand for sugar in the south of Orissa and in Nagpore which leads to an active competition in the purchase and although the price has been raised lately, and the quantity brought into the factory at the time I was there varied from 4,000 to 5,000 Rupees worth daily, there is still a fear, lest the quantity should be too small to make the work pay a fair profit for the season's working. The lowest quantity of sugar that should be turned out from these works should be 3,000 tons a year; which with the present low farming would be produced on 4,000 acres of land, but with the greater capacity of the Aska Machinery and the native demand for consumption, and export by land, we have evidently a market which can only be supplied by the Government giving every encouragement to the growth.

It would answer well enough for Europeans to take up the cultivation of sugar, as the profit from a manageable area would be sufficient inducement. In this respect it differs from the cultivation of grains and seeds and from cotton also which are produced in so small quantity from each year that the cost of management would absorb too much of the profit, if an European undertook it. Nor has sugar the great disadvantage of being a precarious crop as

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Indigo is; only one precaution is necessary; and that in Ganjam is easily provided for, the supply of water throughout the year should be secure. It is difficult to understand why Europeans have not taken up this cultivation, I find that the land will yield an equal weight of sugar with land in the West Indies; there is a market for the produce at hand, and labour to be had at 2 pence a day. Yet the inhabitants of this country are emigrating, and some even going to the West Indies to work on the very same cultivation, with no one single advantage. The whole difference between the two countries that causes this remarkable state of things is that there is capital in the one country, and not in the other.

If English settlers brought their money and intelligence to bear upon this cultivation, Ganjam could, I am convinced, undersell all the great sugar growing countries of the world; but we need not wait for them. There is a population sufficient and as much enterprize as could be expected, and if the Government acting in the capacity of landlord, did all that is in its power to help the cultivators, it might without taking any part in the actual cultivation or advancing money, give such a stimulus to the growth of sugar, as would make it the great staple of the District.

In looking through the expenses of sugar cultivation, I find that there is as much enterprize as could be expected where those who bear the toil and risk, have to pay the profits of their work, to those who supply the capital required. I am told by people of all classes that where the sugar grower works with borrowed money, his cane yields him no better profit than Rice, and those who take up the growth of sugar are very often induced to do so by the trifle of ready money they obtain as an advance from the merchants to secure the crop. The several expenses of a sugar garden are, the cost of the cuttings (or seed cane.) The land Revenue; preparing the land by manuring, &c., watering, and buying or hiring the mill and pans for manufacturing the Goor. The usual size of a garden is about 10 Burnums or 2 acres, the cuttings for which, cost usually 40 Rupees. The Assessment on the land is, I believe, about 30 Rupees; I have an account of the cost of cultivation, but

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I do not trust it sufficiently to quote it. The cost of watering depends upon the position of the land, but sites are usually chosen where irrigation can be had a part of the year and where a very shallow well will supply water with the least labour when the irrigation fails. The purchase of cuttings is in most cases the greatest item of expense, and as the money has to be laid out a whole year before the crop is cut, the interest is very heavy upon that portion of the outlay. The Revenue is also taken before the crop is sold, and money has to be advanced on that account. The cost of cultivation having in like manner to be advanced, the land is poorly worked and sparingly manured, and as the cost of watering must be kept down as low as possible for the same reason, land is chosen where water is near the surface, whether it is liable to flood, or is difficult to drain, or in other respects unsuitable for a sugar crop. In short the cultivation generally is carried on under the disadvantages of the very cheapest farming, and as those who lend the money work upon the common Indian principle of taking all that they can get when they have a chance, without reference to the future; the growers find themselves with little profit even in the best seasons, and in case of accident hopelessly in debt. Under such circumstances, it is no wonder that the extension of the growth of sugar is slow, although experiment has shown, that under good farming, the profit from an acre is very moderately estimated at 100 Rupees.

The Government might do something to remove these difficulties, and the European purchasers might also help. The most important step the Government could take would be, to secure a certain supply of water to land suitable for sugar, so as to remove the cost of working wells and make water so cheap, that as much may be given to the cane as it can take up and convert into sugar. This will, if well managed, work favorably in more ways than one. The best land may then be chosen having soil suitable, and being capable of good drainage. In Rajahmundry where the wells were 15 feet deep, working them was so expensive, that a supply of water for an acre from a channel flowing through the year, was considered by the ryots worth 50 Rupees in the saving of labour only; so wells are not used, and the farming altogether is poorer, but the

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water would be worth no less; this estimate, it must be remembered, is made by those who had to pay for the water, and who calculated only the cost of the quantity they raised from the wells, whereas the supply taken from the channels was at least double and it contained a manure not found in well water. In consequence of the very favorable climate of Ganjam in which rain falls in almost every month of the year, and for 7 or 8 months there is a stream in the rivers, the cost of a constant supply of water for the year would be smaller than it is in most Districts, and as the monsoon there is hardly less certain than it is on the western coast, there would be nothing precarious in the supply of water.

The works I would recommend for this cultivation are, annicuts on the considerable streams, and tanks on the smaller tributaries so arranged, that when the river failed, the tank water might be thrown into the channels. The country seems well adapted for works of this kind and the land suitable for sugar, (if such irrigation is given to it) is unlimited. In speaking of this to a wealthy land holder, he thought the plan all very good, but he believed the whole soil of Ganjam to be so peculiar, that "bunds of tanks could never be made of it," I need not say that this was purely imaginary, and Major Birdwood will gladly undertake to prove to the contrary as soon as he has determined on suitable positions for his works, and obtained sanction for the sums required to build them.

Another relief that the Government might give to the sugar growers is to take the Revenue from the land after the crop is sold, holding the land as security; I am quite aware that there is not one Sheristadar in the service who would not object to this; and it would be a most unpopular move with the influential people of the country, because it would help to relieve the ryots from the thraldom in which they are held by the capitalists. So much is this mode of relief objected to, that when a gentleman in Rajahmundry offered to pay the kists for the sugar growers, a party of Sowcars offered him 3,000 Rupees not to begin that system. If the security is good, the Government will not, I am sure, object to this innovation; and I am certain, if it was tried, it would be found

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that no native land-owner would allow the field to pass out of his possession that had once yielded him the full profits of a sugar crop. Land let on such favourable terms, and supplied with water for sugar the whole year through, might well be paid for at 15 Rupees the acre; it would be worth 50 Rupees, but 15 would pay the Government well. Where very high profits are received from the land, as there would be in this case, there will soon be an intermediate man in possession of it who will be the gainer by the reduced Assessment, not the actual cultivator. Even with the Assessment I name, the land would be saleable at a high price, and the man of capital would be the sugar grower; the cultivator would then be his servant; paid it may be from the crop, but he would not as now have risked the cost of cultivation. The owner who possesses land so valuable will not only secure its being cultivated, but will see that the right crop is grown, and to do this, his terms with the cultivator must be liberal. I believe that nothing would so certainly lead to a class of wealthy land-owners as an irrigation suited to the growth of sugar, and terms favorable to introduction. And I have not yet seen any province of the Presidency better suited to the plant and its high cultivation than Ganjam.

I have noticed the comparatively large sum required for the cuttings of a new sugar garden, and the want of money for purchasing them will be an impediment to the growth, when the Government has done all that I recommend. I am generally averse to Government attempting any cultivation of its own, simply because my experience leads me to expect that no good will result from it. I would otherwise suggest that a few acres of land should every year be planted with cane to be distributed as cuttings; I believe that great encouragement might be given by this means, and at no expense as the actual cost under tolerable management would make them very cheap to the purchaser, but the success of this would depend upon those who undertook the management, and I cannot say who has either time or taste for that. I have however suggested this mode of giving an advance, to the owners of the Aska sugar factory and I am perfectly certain that it is worth their while to make the trial.

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Before leaving the subject of sugar I must be allowed to call attention to the factory at Aska which is now the centre of a traffic on which the prosperity of a great portion of the Ganjam District depends. The variety of trades and manufactures to which it has given rise can only be understood by following the processes in the factory. But its effect may be in some degree estimated by a consideration of the facts, that the consumption of fuel is about 24,000 Rupees worth annually and 6,000 tons of Goor will, it is expected, be this season purchased from the ryots at a very remunerative rate. If this supply is obtained, more than 3,000 tons of sugar will be shipped, and the profits from the works will be satisfactory. But whether working to the profit anticipated or to loss such as it has hitherto had, it has equally a claim to every help from the Government. The enterprizing owners have run a great risk, and several have met with a loss not liking to go on, in the venture. A capital has been sunk which would have made no insignificant appearance in our list of Public Works; very few of which indeed approach the Aska factory in cost, and it is more directly beneficial than almost any thing that has been done by the Engineer Department, excepting only our largest irrigation works, from the sum it annually circulates in the District and which will this season nearly equal in amount half the Revenue of the Collectorate. I am induced to offer these remarks because I have met with a feeling here and there that such great works might very well be left to themselves. There is a very common notion that great manufacturers make great profits, and can fight their own battle and moreover that they have rather a too determined way of asking for what they want. This may be true in some cases, and I hope it may be so with the Aska manufacturers. Their success will be a most valuable example; they will deserve all they earn, and if their demands are always as reasonable as they now are, they cannot be too resolute in making them. What they most want are, encouragement to the growth of sugar, and such fine roads elsewhere as that which has been opened to their benefit, between Aska and the port of Moonsoorcottah.—*Observations made on a tour in Ganjam, in March and April* 1856.—*By Lieut. Col.* F. C. COTTON.

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On Wood Oil.

The Balsam obtained from various trees of the order DIPTEROCARPEÆ.

The value and importance of this article of Indian produce invests all information existing on the subject with much local interest.

Up to a recent period it appears to have been little known in the Home market at least as far as regards its medicinal properties.

In 1854 Mr. CHARLES LOWE, Assistant in the Royal Institution, Manchester brought it to the notice of the Pharmaceutical Society, under the description of "*A new variety of Balsam of Copaiba*" in the following terms :

"An organic fluid was lately placed in my hands by Mr. Grace Calvert for examination, which he had received from an oil merchant of this city, who stated that all he knew of the substance was, that it was obtained by the incision of a certain tree growing on the coast of *India.* From the characters it presents I have ascertained it to be a balsam of copaiba, but as it differs in some of its properties from other balsams that I have examined, I forward you the following notice, in hopes that it may prove interesting to some of your numerous readers.

In appearance this balsam of copaiba is dark coloured and turbid. Its turbidity is due to a greenish resinous matter, held in suspension, which is, however, easily separable, either by filtration or deposition, leaving a brown transparent liquid of sp. gr. 0.970. When the latter fluid is submitted to a careful distillation it yields :—

Essential oil........................	65	per cent.
Resin................................	34	,,
Acetic acid and water............	1	,,
	100	

I find that the essential oil in its various reactions with potassium, iodine, nitric acid, &c., and moreover in taste, exactly corresponds with those presented by pure essence of copaiba. The resin left by distillation of the balsam, either with or without water, is, if deprived of the whole of the essential oil, extremely hard. Its entire solubility in coal naphtha proves the absence of any of the soft resin which exists in most of the

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copaiba of commerce. This hard resin (copaivic acid) being most probably the active principle of balsam of copaiba, I am induced to think its quantity and purity in the one I have examined is indicative of its superior value as a medicament. The dark colour of the balsam may perhaps limit its employment, but the large quantity of copaivic acid it contains renders it valuable, as the latter may be made available by heating the filtered balsam to the boiling point with a small quantity of caustic potash or soda lye, of sp. gr. 1.34, and separating the resinate of potash or soda from the essential oil. The alkaline resinate may then be dissolved in water, giving a colourless solution (similar to Frank's specific), or the balsam may be treated with magnesia to form the ordinary copaiba pill.

I have in conclusion remarked:—

1st, That the essential oil obtained by the distillation of balsam of copaiba has, like several other hydrocarbons, the property of dissolving indigo.

2ndly, The new variety of balsam above described presents the curious property of becoming gelatinous (so much so that the tube may safely be inverted), if heated to 230° Fah., even if a *sealed* tube be employed. This character being dissimilar to the one given in the same circumstances with such other balsams as I had at my disposal, I am induced to attribute it to the large amount of "*hard* resin" it contains.

3rdly, Balsams of copaiba in general give, on distillation with two per cent. sulphuric acid, a beautiful blue volatile oil. Chlorine, hypochlorite of lime, and bichromate of potash, give a similar character with the balsam, which appears to me to be due to the oxidation of the hard resin, as I have been unable to obtain but a small proportion of the blue-coloured oil when I employed a balsam containing "*soft* resin," comparatively to when I made use of the one above described, which, as I have already remarked, contains only "hard resin." A further support of this view is, that pure essence of copaiba assumes no blue colouration when distilled as above.

4thly, That cold sulphuric acid produces a purple colouration with balsam of copaiba, similar to that obtained by its action on cod-liver oil. Such being the case, it is probable that a small quantity of it, mixed with olive or some other oil, may be sold by unprincipled persons as genuine cod-liver oil.—*Pharmaceutical Journal,* XIV. 65.

In 1856 the same substance was again noticed by Mr. DANIEL HANBURY under its ordinary name of *Wood Oil, a substitute* for *Copaiba.*

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"Among the drugs that have recently appeared in the London market, I have observed one article to which I am desirous of drawing attention. It is a liquid imported in considerable quantity from Moulmein in Burmah, and offered for sale under the name of *Balsam Capivi*, but known in India as *Wood Oil* or *Gurjun Balsam*.

To Balsam of Copaiba, however, it presents so remarkable a resemblance, that, but for the locality from which it was imported, it would hardly have been noticed as anything else than Copaiba of rather unusually dark colour.

In the Paris Universal Exhibition there are two samples of a similar liquid, labelled *Wood Oil*, one of them being sent among the Materia Medica of Canara, the other from the Tenasserim provinces. Through the kindness of Dr. Royle, specimens of each have been placed at my disposal. Though comparatively a new drug in English trade, *Wood Oil* is an article of common occurrence in the bazaars of India.

From its similarity to Copaiba, it might be supposed to have its origin in some plant nearly allied to *Copaifera*: such, however, is not the case, it being the produce of the natural order *Dipterocarpeæ*.

The following is Roxburgh's account of the manner of obtaining it from *Dipterocarpus turbinatus*, an immense tree, native of Chittagong, Tipperah, Pegue, and other places to the eastward of Bengal.*

'This tree is famous over all the Eastern parts of India and the Malay Islands, on account of its yielding a thin liquid balsam, commonly called *Wood Oil*, which is much used for painting ships, houses, &c.

'To procure the balsam, a large notch is cut into the trunk of the tree, near the earth (say about 30 inches from the ground), where a fire is kept up until the wound is charred, soon after which the liquid begins to ooze out. A small gutter is cut in the wood to conduct the liquid into a vessel placed to receive it. The average produce of the best trees during the season, is said to be sometimes 40 gallons. It is found necessary, every 3 or 4 weeks, to cut off the old charred surfaces and burn it afresh; in large healthy trees abounding in balsam, they even cut a second notch in some other part of the tree, and char it as the first.

'These operations are performed during the months of November, December, January and February. Should any of the trees appear sickly the following season, one or more years' respite is given them.'

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* *Flora Indica* (ed. Carey) vol. ii. p. 613.

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The same author also states that Wood Oil is afforded by *D. costatus (D. angustifolius* W. et A.), *D. alatus* Roxb. and *D. incanus* Roxb., the last mentioned being reputed to furnish the largest proportion of the best sort.

Closely allied to the Wood Oil of *Dipterocarpus* is the oleo-resin termed *Camphor Oil,* produced by *Dryobalanops Camphora* Colebr., a tree of the same natural order. For a specimen of this oleo-resin and of an analogous liquid called *Lagam Oil,* both brought from Sumatra by Dr. Junghuhn, I am indebted to the courtesy of Dr. J. E. De Vrij of Rotterdam.

Wood Oil, as imported from Moulmein, is after filtration, a transparent, dark brown liquid, of somewhat greater consistence than Olive Oil, a sp. gr. of .964 and an odour and taste like copaiba, though perhaps hardly so strong. One part of it treated with two parts of alcohol sp. gr. .796, is dissolved with the exception of a minute quantity of darkish flocculent matter, which subsides upon repose.

But its most curious property (as noticed by Mr. Charles Lowe with reference to a liquid which I suppose to have been *Wood Oil**) is that exhibited when it is heated in a *corked* vial to about 266° F. (130° C.)† Thus treated, it becomes slightly turbid, and so gelatinous that the vial may be inverted, even while hot, without its contents being displaced; and on cooling, the solidification is still more complete. Gentle warmth and agitation restore to a great extent its fluidity, but solidification is again produced upon the liquid being heated to 266°. Copaiba displays no such phenomenon.

According to Dr. O'Shaughnessy, when Wood Oil is heated in a retort, a yellowish white, *crystallizable,* solid substance having many of the properties of benzoic acid sublimes into the upper part of the vessel, to the extent of about one per cent. of the Wood Oil taken. In my own experiments, I have not detected any of this substance. It is true that when Wood Oil is heated, a scanty, opaque white sublimate condenses in the cooler part of the vessel, but this appears to arise from the condensation of a little water among the minute drops of essential oil, since it is not produced if the Wood Oil has been previously agitated with some fragments of dried chloride of calcium.

With regard to its medicinal properties, there appears to be no doubt

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* On a new variety of Balsam of Copaiba, *Pharmaceutical Journal,* vol. xiv. pp. 65, 66.

† Mr. Lowe says 230° F., but a much more striking effect is produced on the *Wood Oil* by the temperature I have named.

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from an extensive set of experiments instituted by Dr. O'Shaughnessy, confirmed by trials made by other practitioners in India, that Wood Oil is nearly equally efficient with Copaiba, in the diseases in which that drug is indicated.* It may be administered as an emulsion, or in pills made up with magnesia. Dr. O'Shaughnessy has used the essential oil in doses of from 10 to 30 drops.

From the close similarity of Wood Oil to Copaiba, a mixture of the two may be anticipated; from pure Copaiba, such a mixture will probably be detected by a difference in its optical properties."—*Pharmaceutical Journal*, XV. 321.

Still *later* "*a note*" appeared in the same serial translated from a paper by Mr. GUIBOURT, in the French *Journal de Pharmacie et de Chimie* for September 1856, which we here reproduce;

"This curious Indian production, named by the English *Wood Oil* or *Gurjun Balsam*, has already formed the subject of two notices† published in the *Pharmaceutical Journal and Transactions*, by Messrs. Charles Lowe and Daniel Hanbury.

Mr. Lowe, who knew merely that this resinous liquid is extracted in India from incisions made in a tree, considered it Balsam of Copaiba rendered turbid by a greenish resin suspended in it. [He found that] the filtered balsam formed a brown transparent liquid, which yielded by distillation as follows:

Essential Oil....................	65
[Hard] Resin.....................	34
Acetic Acid and Water............	1
	100

According to Mr. Lowe, the volatile oil possesses all the characters of that of copaiba; and the "*hard* resin," which he regards as pure Copaivic Acid, exempt from the "*soft* resin" which, according to him, exists in the greater part of the copaiba of commerce, appears to him indicative of superiority as a medicine. I must acknowledge that I but ill comprehend this conclusion, and that I am the less convinced of the identity of the hard resin with copaivic acid, since Mr. Lowe has recognized in the new resinous balsam the singular property of becoming solid when exposed in a closed vessel, to a temperature of 230° F. Copaiba presents no similar phenomenon.

I find stated moreover this difference, viz., that the new balsam distilled

* *Bengal Dispensatory* (1842) pp. 222—224.

† The two selections from the *Pharmaceutical Journal* given above.—ED.

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with the addition of a small quantity of oxidizing agent, as chlorine, hypochlorite of lime, or bichromate of potash, yields an essential oil of a fine blue, whilst ordinary copaiba containing "*soft* resin" (I still scarcely understand), affords hardly any coloured essential oil. The notice concludes with pointing out a possible sophistication which appears to me little to be feared; it is, that cold sulphuric acid produces with copaiba a purple colouration similar to that obtained with cod-liver oil, so that, as the author supposes, dishonest persons might substitute for the latter, a mixture of olive oil or of some other fatty oil, mixed with a small proportion of copaiba.

Mr. D. Hanbury informs us in his notice, that Wood Oil is extracted from *Dipterocarpus turbinatus* by a very peculiar process, which I will state in a few words, in order the better to show the nature of the product. To obtain the oil, a large incision is made in the trunk of the tree at about 30 inches from the ground, on which a fire is lighted and kept up until the incision is charred: soon after this, the liquid begins to flow. It is conducted by a little trough into a vessel placed to receive it. The average produce of one of the better trees in a single season, is 30 gallons. Roxburgh [from whom this account is taken] adds that *Wood Oil* is also produced by *Dipterocarpus incanus*, *D. alatus*, and *D. costatus*. The first of these three is reputed to yield the best sort, and in the greatest quantity.

The Wood Oil which forms the subject of Mr. Hanbury's notice has been imported in large quantity from Moulmein in Burmah: when filtered, it is a transparent liquid of a somewhat dark brown when seen by transmitted light, but appearing opaque and of an obscure green if viewed by reflected light. It possesses therefore, in a very marked degree, the dichroism observable in all resin-oils obtained by the action of fire. I particularly notice this character which determines the nature of Wood Oil, and shows that it is not simply a natural product like Copaiba; but that it is in part the result of a liquid modification of the *Dipterocarpus* resin, effected by the agency of heat. This Moulmein Wood Oil is of somewhat greater consistence than Olive Oil; it has a sp. gr. of ·964, and possesses an odour and taste very analogous to those of copaiba. It dissolves in twice its weight of absolute alcohol, with the exception of a minute residue which is deposited upon repose.

But the most curious property of this oil, already recognized by Mr. Lowe, and afresh observed by Mr. Hanbury, is that of solidifying when heated in a closed vial to 266° F.; at this temperature the oil becomes turbid and so gelatinous, that it is not displaced upon the inversion of the

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vial. After cooling, the solidification is yet more perfect; but a gentle warmth, assisted by slight agitation, restore its former liquidity. Mr. Lowe has given the temperature of 230° F. for the solidification of the oil: I suppose that the different temperatures noted by these two observers may be accounted for by some difference in the liquids on which they operated; for as the sorts of copaiba furnished by different species of American *Copaiferæ* and the turpentines by various pines and firs, are not identical, so we may reasonably conclude that the Wood Oils yielded by various species of *Dipterocarpus* are not absolutely similar; the greater or less degree of heat to which the oil has been subjected in the process of extraction, may also cause a variation in the properties of the product.

What I assert here is not a matter of supposition, but at present of certainty. At the Universal Exhibition of 1855, there were two samples of Wood Oil, the one sent from Canara, the other from Tenasserim. One of these samples (I do not know which), enclosed in a small white earthen pot, which in fineness of paste was midway between stone-ware and porcelain, had been given by Dr. Royle to M. Delesse, the member of the international jury who had been commissioned to report upon the bitumen and petroleum forwarded to the Exhibition. M. Delesse not finding it to be what he was seeking, sent me the specimen, which I judged at once must be the new copaiba announced by Mr. Lowe. In fact, it approached much nearer to the balsam examined by Mr. Lowe than that which has been presented to me by Mr. Hanbury.

The Wood Oil of Mr. Hanbury has almost the liquidity of Olive Oil; held up to the light of the sun, it is seen to be perfectly transparent, and of the colour of dark Malaga wine: seen by reflected light, it appears opaque, and of an olive green. With ammonia and magnesia, it behaves in a very different manner from Copaiba. Mixed with liquid ammonia 22° B., in the proportion by weight of 5 parts of Wood Oil to 2 parts of alkali, it immediately forms an opaque and very thick mixture, which does not alter by keeping.

It does not solidify upon the addition of a sixteenth of its weight of calcined magnesia, and the two bodies separate upon repose.

The Wood Oil of M. Delesse has the appearance of a thick and slightly gelatinous liquid. After having deposited a small quantity of green resin which was suspended in it, it became almost transparent: placed between the eye and the sun, it is seen to be of a pure deep red: viewed by reflection, it still appears red, but turbid, and resembles a liquid in which finely-powdered Cochineal might be suspended. The complimentary colour of

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red is not therefore apparent by this means, but it becomes manifest when after agitation, a thin layer of liquid covers the upper sides of the bottle. Then, in whatever way we look at this thin layer, it appears of a beautiful green hue.

This same green colour appears again and remains, when, after having dissolved the Wood Oil in alcohol, the solution is left to spontaneous evaporation : one may then see towards the upper part of the capsule, between the portions of green resin, white starry tufts which are due to a peculiar principle, the future examination of which I leave to those who have a larger quantity of the liquid at their disposal. As to the resin, it has acquired a permanent green hue, which is also perceptible in the dry resin which remains after the Wood Oil has been boiled for a considerable time with water. This green colour, which is that also of the beautiful Piney Resin (*Vateria Indica* L.) that was shown at the Exhibition, establishes a point of relation between two products originating in trees belonging to the same family, that of the *Dipterocarpeæ*. But there the resemblance stops, for the resin of *Vateria Indica* is insoluble in alcohol, and very imperfectly so in ether, whilst the green resin of Wood Oil is easily soluble in either of these menstrua. Finally, the Wood Oil of the Exhibition behaves as Copaiba, when treated with ammonia or calcined magnesia. With one sixteenth of calcined magnesia it very speedily solidifies, and a mixture of it with ammonia becomes liquid, and almost transparent, after an instant of opacity.

I am far from concluding with Mr. Lowe, that the two oleo-resinous bodies [Copaiba and Wood Oil] are chemically identical; but as regards their employment in medicine, I think, as in the case of bodies of analogous composition, such as turpentines and balsams, liquid or solid, all their vegetable components may be of use as a remedy for a catarrhal condition of the mucous membranes. I may remark, in conclusion, that Mr. Hanbury's Wood Oil, and that from the Exhibition, have probably not been extracted by a similar process. It seems to me that the former has been obtained by the action of fire in the manner described by Roxburgh; the latter has doubtless been obtained without the intervention of this agent, for I do not find in it the indication which characterizes oils that are the result of the action of fire upon resins."—*Pharmaceutical Journal, XV.* 332

The foregoing extracts show how valuable an article of commerce these oils which are largely produced both in India and Pegu are likely to become when they shall have obtained the amount of attention they deserve.

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SCIENTIFIC INTELLIGENCE.

Appearance of Coal at Nellore.

(Extract of a letter dated February 4th, 1857 from G. POWELL, Esq. Assistant Engineer N. D. to Col. FABER, Chief Engineer, Madras.)

"I proceeded to the Caligherry Talook of Nellore in order to procure if possible, some more coal, from or about the locality where, in 1856 I found a piece of tolerable good quality. * * * * * * * * * *

* * * * I have found in four different spots, small pieces of a black heavy substance, possessing every appearance of coal: which, from its strong similitude to that matter, I have taken the liberty of calling "*coal*:" and consequently the places from whence I eventually procured it in quantities, "*Seams*:" to each of which, for the sake of reference, I have attached a letter, Ex: Gr: *Seam A. Seam B.* &c., leaving however its merits and quality to be judged of and proved by a more competent authority, for which purpose, I collected a small quantity from each *Seam*, and have yesterday despatched two coolies to your Office, with samples of the various sorts found, together with their accompanying clays, crystals, sandstone and limestones: having at the time of collection carefully noted by an inclinometer, their dip and strike. In some instances however owing to the variety of directions in which the coal lay, I could obtain no positive dip or strike but was obliged to take an average one by noticing the angle and direction which the majority had.

"With the exception of one specimen called "*coal in laterite*," the whole has been collected from within a circle of about five miles diameter of which, a village called Yapanapy, (three miles North East of Caligherry) may be considered as the centre.

"The position of the various "*Seams*" is as follows. *Seam A.* is about half a mile due North of Yapanapy, in the South bank of a nullah, which forms the Southernmost supply channel of the Chinnacranca tank and running nearly due East and West passes half a mile North of Yapanapy. *Seams B. C.* and *D.* are in the banks of branches of the same nullah: but these run nearly midway between Yapanapy and a village called Polumpaud. It was I believe, between the latter, and a village called Iyapareddypollium where I found the coal in 1856; which I imagine must have been detached and carried some considerable distance, from its bed in one of these nullahs, by the water which usually flows down them in the monsoon season.

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"From a few samples I have seen of various stones said to have been brought from the Oodagherry Talook; and from the report of Natives, I should consider that the country in that direction was far superior to the country about here, in a geological point of view. Some of the stones which are said to come from Oodagherry, certainly look very like ordinary mountain lime: but as I am at present without any of the various chemicals requisite for proving limestone, I am unable to speak positively on the point.

* * * Upon showing a small piece of "Blue Mountain limestone," which I generally carry about in my pocket, to a Native while out exploring about nine miles West of the town he informed me, that he had seen stone of the same "caste," either in the hills between Dootaloor and Oodagherry or in the mountains, West of latter town; and that it was generally used for making images, and pillars of small temples."

We have much pleasure in subjoining the following Report by Mr. Wall, the Mineral Viewer, upon the several specimens forwarded by Mr. Powell.

The minerals are chiefly of volcanic origin, consisting of specimens of chrystallized schorl and mica; there are also several pieces of sedimentary rocks, micaceous sandstones and cherts, ferruginous sandstone, two or three pieces of chert, probably silicified wood, and samples of nodular limestone or kunkur.

The series indicate a volcanic district with sedimentary deposits, the debris of those in the neighbourhood; none are at all connected with the occurrence of coal. The black substance looked upon by Mr. Powell as coal is schorl, this substance is readily distinguished from coal by its non-combustible properties.

Besides the minerals enumerated above there is a combustible substance amongst them, asphaltum, this differs much in appearance from coal and when heat is applied to it, it will be found to melt very readily.

The following is a list of the minerals forwarded :—

VOLCANIC ROCKS.

Chrystallized schorl.
Do. mica black and white.
Schorl and mica imbedded in compact quartz.
Granular quartz.
Varieties of granite in a state of decomposition.
Kaolin or decomposed felspar.

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Pitchstone.

Asphaltum.

SEDIMENTARY ROCKS.

Ferruginous sandstone.

Micaceous do.

Do. schorl.

Chert.

Kunkur

Amongst the above may be mentioned as of economic value.

Asphaltum.

Kaolin.

Kunkur.

Further search should be made for the Asphaltum if it can be obtained in any quantity.

Further samples of Kaolin should also be forwarded from the district, that of a white color being valuable for pottery.

I have also examined the small pieces of the lumps of coal found by Mr. Powell in 1856. It is slightly bituminous or coking coal, and is of a quality very superior to those samples I have had the opportunity to examine as the production of this country. Had this piece been transported from its position "in situ" by the action of water to the place where found, it is not probable but that a further search would have produced more specimens; this from Mr. Powell's letter seems not to have been the case.

The most reasonable explanation regarding it seems to be that it is a piece of foreign coal that has been conveyed into the district and accidently dropped.

If however the opportunity offers to Mr. Powell for further search he should do so, along the nullahs in direction towards their rise and towards the part of the country where the sedimentary rocks are to be observed.

I am informed by Dr. Hunter that D. White, Esq., forwarded to him in 1850, from the Tada Talook in Nellore, a piece of coal. Upon examining this specimen now in the Museum of Industrial Arts, I find it to be Lignite; this substance is met with very frequently in many parts of India, and occurs in the alluvial deposits in isolated lumps, it burns with much flame and smoke, emitting a strong pyroligneous odour, and upon examining the ash after combustion, it will be found to preserve the original form of the material, it is somewhat lighter in weight than coal, the specific gravity of some pieces I met with in the bed of the Godavery was 1·23, whilst that of Coal is from 1·30 to 1·45.

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Specimens of Cotton and information desired with a view to the Chemical investigation of the Cotton Plant.

Mr. Mallet, Professor of Chemistry in the University of Alabama W. S. is engaged in investigating the Chemistry, Natural history and Physical condition of the cotton plant, and has applied to the Court of Directors for specimens and information which may enable him to extend his researches to the varieties produced in India.

The following Memo. was at the same time drawn up by Mr. Mallet to serve as a guide as to the kind of information desired by him from those supplying him with specimens.

It would be desirable to have specimens from four or five of the Cotton growing localities of India, differing in soil and climate, those which are most important now, or may be expected hereafter to become so.

Separate analysis should be made of the ash of the following parts of the plant, and specimens will therefore be required of

(1st.) The root.
(2d.) The stem (with smaller branches and twigs.)
(3d.) The leaves.
(4th.) The bole or pod.
(5th.) The seed.
(6th.) The fibre or cotton.

About four pounds of each of these parts (in the *green* state) would be needed, hence a sufficient number of entire plants should be collected to yield at least the above amount of each part.

The total weight of the entire plants clear of earth and in their fresh green state must be stated, they must be weighed free from rain or extraneous moisture.

The specimens should be gathered in dry weather and *just after the bole has fully opened.*

The whole of the root, as of every other organ should be taken, each specimen should then be put up in paper or cotton cloth, and distinctly marked and referred to a list, the marks legible and indelible.

Besides the plants, about four pounds weight of the soil in which they were grown should be also put up in cotton cloth, and similarly labelled, carefully *referring* to the plants taken therefrom.

Information as to the following points accompanying the specimens would be very important and valuable.

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(1st.) Nature and depth of the soil as to dryness or moisture retentiveness, what other crops are grown in it, is it deemed very fertile, any special weeds ?

(2d.) Geological and topographical character of the District, nature of underlying rock, level above the sea, well or ill-drained naturally ?

(3d.) Climate (especially as regards *rains*, their amount and the seasons at which they fall), is irrigation employed, when and how long in the year ?

(4th.) Kind of seed used and whence obtained.

(5th.) General character of plant whether herbaceous or tree cotton ?

(6th.) Average height of plant and spread of branches, distances from plant to plant ?

(7th.) Average spread of roots in depth and laterally ?

(8th.) Mode of cultivation, time of planting, distance at which plants are placed apart, *amounts of labor bestowed upon weeding during growth* time, of flowering time, of picking, duration of picking, &c., "*ginned*" cotton fibre produced per acre, weight produced per hand employed.

(9th.) Manure used, if any Cotton seed returned to the soil. Stalks allowed to decay on the field.

(10th.) Diseases or ravages of insects to which the plant is subject.

Some samples of the "ginned" cotton ready for market might be useful as affording by comparison with the raw fibre an idea of the degree of care with which the seed is separated. The value of the fibre depends to a very great extent upon the attention given to this mechanical preparation.

Graphite in Travancore.

(Extract of a letter dated Trevandrum, 16th July 1857, from Lieut. General W. CULLEN, Resident at Travancore and Cochin to E. MALTBY, Esq., Acting Chief Secretary to Government, Fort Saint George.)

"In continuation of former* communications on the existence of Graphite in Travancore, I have now the honor to report that I have just returned from a visit to the locality from whence the specimens were procured by me, though presented by Mr. John Loch, for the Exhibition in London in 1851 ; and I have brought in with me upwards of a ton of the ore, and out of which I ex-

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* Vide p. 257, Vol. I. No. II. N. S. of this Journal.—ED.

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pect with ease to select at least 10 or 12 cwts. perhaps more, which will be nearly if not entirely pure and free from laterite, clays or particles of quartz, and from which I hope that a fair estimate may be formed of its commercial value, when the working of the mine is properly conducted.

"The plumbago deposit is at a place called Ponalaul in the Oolamalakul Property about 10 miles from Trevandrum in a North East direction on the road to Areenaud. It is found in a rather loose gravelly laterite, and 4 or 5 feet below the surface.

"A hole of about 15 to 20 feet diameter and about 4 to 5 feet deep was first sunk to the plumbago which appeared to form a nearly horizontal layer of from 1 to 2 feet in thickness, but its breadth was not correctly ascertained. Having laid open the whole surface of the plumbago in the pit, and as it seemed to tread in a South West direction, a trench B C was dug from the well at B towards C about 18 feet long and 3½ to 4 ½ deep until the plumbago vein or deposit was again met with, and it was traced as far as C where a narrow trench was dug at right angles to B C, and the Graphite was there again found. From the limited area exposed in the original pit about 1¼ ton of Graphite was obtained. The deposit appeared to be extensive and traces of Graphite were also discovered in other holes sunk at various distances from the main deposit. The total quantity of crude or uncleared ore brought in was about 2,700 lbs., of which perhaps 3 or 400 lbs. may have been strictly foreign matter or laterite clays, but in some of the masses it required a good deal of trouble to get rid of the clay which formed thin seams or partings in the masses of ore, and which to separate entirely from some of the smaller lumps, required a good deal of abrasion and loss. With more care and leisure which I could not at the time readily afford, I have no doubt I might have obtained from 1,800 to 2,000 lbs., instead of as now only 1,000 to 1,200 lbs. of pure Graphite from the crude collection of 2,700 lbs.

"The hire for digging the above 2,700 lbs. crude ore was about 3 Rupees, the carriage by men to Trevandrum 12 Rupees or total 15 Rupees or at the rate of about ½ Rupee per 100 lbs., or for the

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cleared Graphite, which I have prepared for shipment, at the rate of 1 Rupee per 100 lbs., but as I have above noticed I have little doubt that with ease it may be put down at Trevandrum which is within 1½ mile of the sea at ¾ Rupee per 100 lbs., without including any duty that the Travancore Government may hereafter consider it advisable to impose.

"From the smaller fragments of the Graphite I have by pounding it and washing the powder in water endeavoured to separate the clays, and I believe I have succeeded to a considerable extent, and I shall also prepare for dispatch 1 or 2 cwts. of this powder.

"I beg to forward a few coarsely made pencils prepared from the Graphite by a common peon, which would seem to prove the good quality of the material. I have prepared boxes to hold about 200 lbs. each, and the Government may perhaps approve of its being dispatched by sea from Cochin to England, and may approve of instructions being sent to the Collector of Malabar or Master Attendant at Cochin, to make arrangements for its shipment.

Government Horticultural Garden, Ootacamund.

For some years, I have read the Reports of this Government Institution with much pleasure, although I had not seen Mr. McIvor or his Garden ; but this year, my forest duties necessitating my proceeding to the Neilgherry Hills, I delayed forwarding the remarks called for, until I had an opportunity of ascertaining by inspection, and noting in some detail, "The present condition, resources and prospects of the Institution."

Ten years have elapsed since the Marquis of Tweeddale originated the scheme of this Garden, and the Court of Directors selected (on the recommendation I believe of Dr. Royle and Sir Wm. Hooker) the present Superintendent, who is eminently qualified by early training at the Royal Gardens, Kew, for carrying out the objects of the Institution.

The earlier stages of the Garden's existence have passed, and I need not perhaps allude to the great difficulties to be overcome

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in commencing a Garden on these Mountains with a scanty income of 100 rupees per mensem, and the experience to be gained before exotics from various lands could be successfully introduced. I will, however, observe that the present condition of the Garden is very creditable to Mr. McIvor, who has labored by himself from the beginning without the aid of professional advice, and although much remains to be done, yet on making inquiry, I find it generally admitted by visitors that great progress has been made during the past year.

In the upper part, the borders and beds have been well planned and arranged, and have a neat and trim appearance. The view from the higher terraces is romantic, and from them only can the general plan be well seen and understood. On the grassy banks along the sides of the main walk, are clumps of showy flowers, and scattered through the ground are fine standard *Acaciæ*, *Eucalipti*, *Coniferæ*, *Psoraleæ*, *Swainsoniæ*, *Pultenœ*, *Humeæ*, *Hakeæ*, *&c.* Excepting a few specimens of *Mahonia Laschenaulta*, *Rhododendron Arboreum*, *Sapota Elengoides*, *Myrtus tomentosa*, *Ilex Wighliana and Viburnum acuminatum ;* all the rest of the trees in the Garden seem to be introduced.

The lower part of the Garden is not in good order. It was originally a swamp, and suffers from frost in clear winter nights ; the cold air formed on the slopes of the Mountains, rolls down into the valley and envelopes the herbage, blighting many tender plants. It is now protected from the high winds by rows of Australian trees, and there is a prospect of Mr. McIvor devoting his energies to it as soon as the Conservatory is finished. As Dahlias and many other plants which are not hurt on the upper slopes are killed by the frosts below, and as this evil cannot be entirely averted, it is proposed to make this part a grassy lawn for exhibitions of Native produce, with an avenue of 50 feet in breadth leading from the gate to the Conservatory.

GENERAL RESULTS.—I have great pleasure in observing that the introduction of the seeds obtained through Government from Saharunpore, Darjeeling, China, Australia and the Cape has been most

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satisfactory. A very considerable number of Timber and Forest trees, Shrubs and Herbaceous plants have been secured to the country, and thrive remarkably well, which alone renders the efforts of Mr. McIvor of great importance, especially as the seeds are sufficient for abundant distribution.

TIMBER TREES.—Amongst the Timber trees are the Blue Gum tree, the Deodar and the Patagonian Pine, perhaps I may add the Turkey Oak, Turkey Box and the Irish Yew, these latter are still of small size. The European Pines *(Larix and Abies)* have not answered well. On the other hand, the *Acacia Rubusta* of Australia is in such abundance as to stamp a peculiar feature in the scenery, which is entirely wanting in the drawings of Ootacamund (Colonel McKurdy's) printed 15 years ago.

FRUIT TREES.—The best varieties of English Apples and Pears are cultivated. Figs and Vines grow well. Also Oranges and Lemons—these latter succeed remarkably at the branch Garden "Kulhutty" which I visited and found the following trees bearing fruit,—Natal Plum, Newton Pippin, Malta Orange, St. Michael's Orange, Spanish Citron and Ischia Figs. Numerous grafts and seedlings have been sent to various parts of the country, as to Ramandroog in Bellary, Koodramooka in South Canara, and the Baba Booden Hills, Mysore. A complete set of Fruit Trees is about to be supplied to the Bangalore Garden, from which by reason of its central position and the cheaper carriage, I expect there will be a most abundant distribution of valuable productions radiating over the country.

MEDICINAL PRODUCTS.—The *Digitalis purpurea* (Fox glove) is grown for the supply of the Medical Store on annual indent; the Spearmint and Peppermint thrive remarkably in the Upper Garden and could be supplied in large quantity. Two large and healthy Jalap Plants are in great luxuriance; these Mr. McIvor proposes to remove to the Subsidiary Garden at Kulhutty with the hope of being able to propagate them extensively. This would be a great result. Two Cinchonaceous plants from Patagonia received from Mr. Lobb under the name of *Cinchona micrantha*, and

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a small specimen of the *Cephaëlis Ipecacuanha* are in the Garden, but they appear to suffer from the misty atmosphere. It is of the utmost consequeuce, that the introduction of the true Cinchonas should bc fairly tried on the Neilgherries, and Mr. McIvor is well able to conduct the experiment. The drugs have been hitherto delivered free of charge, it seems to me that the cost of productions should be charged to the Medical Department, as this Institution has always been hampered for want of Funds.

BUILDINGS.—The Conservatory sanctioned at an estimated cost of Rupees 4,300 is far advanced towards completion, and will unquestionably be a great acquisition to the Garden. The structure was designed by Capt. Francis, Engineers, and approved by Mr. McIvor. The delay in its erection has been unavoidable, as reported by the Committee.

The seed-house lately suffered serious damage from fire and requires to be rebuilt. The site selected by Mr. McIvor is close to his Bungalow in a dry and convenient situation. This is a most important department of the Garden, from which seeds ripe and correctly named can be at all times distributed to various parts of the country. An alteration of this old seed-house so as to admit four or even six apprentices and sleeping quarters would be highly advantageous. A plan and estimate amounting to Rupees 1,650 has been forwarded* I understand by the Committee for sanction. This provides I believe for flues and close-fitting drawers, dryness being essential for the preservation of seeds.

* 6th July 1857.

SEEDS.—Mr. McIvor has made some important attempts at growing European vegetable seeds in India. Experimental samples of many kinds have been sent by him to Dr. Wight, and these are now under trial in the Garden of the Horticultural Society, London. If a favorable opinion be given, Southern India will no longer be dependent for kitchen garden seeds upon England, France or the Cape. So far as the seeds have been tested in this country the result has been favorable, especially the Lettuce, Carrots, &c. It has occurred to me that the Soldiers' Gardens of this Presidency should be supplied with Neilgherry and English seed in equal

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quantity, and from the Reports received a few deductions may be drawn as to their comparative value.

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FINANCES.—The statement in future years may be improved by entering more into detail, and showing clearly the various items of receipt and expenditure; as for instance, the expenses of the Kulhutty Nursery and the Horse Allowance for visiting it, and the monthly outlay for labour. These appear at present under the head of "Working expenditure." The accounts should be audited by one or more of the Garden Committee.

In the previous report of the Garden, it was stated that the total outlay was about rupees 200 per mensem, but this year, I am happy to observe that the income has risen to nearly rupees 400 per mensem, being 100 rupees of Government allowance and about 300 rupees by sales ; this shows an encouraging state of progress in a financial point of view, and has allowed Mr. McIvor to carry out considerable improvements in the Upper Garden.

PRICES.—The extreme facility with which many trees and plants may be propagated, and the comparative mildness of the winter, during which season many exotics continue to grow from cuttings (if planted out of the reach of frost) would warrant their sale at a reduced rate.

It is the object of Government to introduce as many species as possible at the lowest cost, consistent with the repayment to the garden of the actual expenses of introduction and propagation, with a sufficient surplus to meet the repairs of buildings, &c. and to admit of the extension of operations.

A strong feeling generally prevails that the prices named in the Catalogue are high, and I cannot doubt, but that advantage would arise from lowering them (as formerly urged by me). I have discussed this point with Mr. McIvor, who naturally adduces the fact that the income of the Garden depends largely upon sales ; I am disposed to meet his objection by recommending that Government should sanction the debit of the actual cost of drugs supplied to the Medical Board, and of trees to the Department Public

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Works. Certain trees, for instance, might be supplied to the roads at one anna each, or rupees five per hundred, and the cooly hire for collecting and preparing the drugs should, I think, be charged to the Medical Department; this Mr. McIvor states would allow of a reduction of 25 per cent.

The Acacia Robusta, Weeping Willow, Cypress, Ivy, &c. are of very easy culture and could certainly be sold at a reduced rate. Fuchsias, Chrysanthemums, Geraniums, &c. &c. would be dear at English prices, but with fruit trees especially a low price is to be desired. Vines and Figs propagate readily from cuttings; Apples and Pears can be grafted during a great part of the year, and a cheaper rate would repay their cost. Plums, Peaches and Cherries are more difficult of propagation, and their price might reasonably be higher. On the whole, it appears to me that a continuance of the present rates will cause a partial failure of the object of the Institution and induce Residents to procure plants and seeds from England instead of availing themselves of the local Establishment, where the same plants are procurable.

In the weekly market at Ootacamund there is an increasing display of fine specimens of Garden produce. The proposal of establishing an Annual Exhibition of Vegetables, Fruits and Flowers is a good one. Government might contribute 100 rupees towards the expenses of this, on the condition that the Committee raise an equal sum from among the Residents.

COONOOR NURSERY.—Before leaving the Neilgherry Hills, I visited the Coonoor Subsidiary Garden in company with Mr. McIvor. It is well sheltered and well watered, situated 1½ mile from Coonoor. Nine gardeners are employed, including the Maistry at the cost sanctioned of 50 Rupees per mensem. The Orange appears to grow here in as great perfection as at Malta or Canton, and when the Garden is in full operation will probably do away with the necessity of keeping up the Kulhutty Nursery which might be then sold with advantage. There would be three Gardens forming a graduated series in one line of road. Alpine, Subalpine, and Tropical, viz., Ootacamund, Coonoor, and Burliar.

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Jack trees.
Nutmeg do.
Clove do.
Allspice do.
Cinnamon trees.
Cocoa do.
Vanilla creeper.
Peach trees.
Orange do.
Lime do.
Pumplemoss trees.
Grenadilla Vine.
Mangosteen.
Rose apple.
Loquat.
Pine apple.

The latter, indeed, is the private property of E. B. Thomas, Esq., Collector of Coimbatore, but from his zeal in Arboriculture, and great liberality to all applicants, its usefulness for disseminating Tropical products is almost as great as if it were public property. In the margin, I annex a list of the Fruit trees, Aromatic shrubs, &c. now cultivated in this rich but confined nook, in which the Cocoa tree, Nutmeg, Allspice, &c., have succeeded admirably, and from which it is the hope of Mr. Thomas, that they may be extensively spread over congenial climates, such as the Wynaad and other parts of Malabar.—*Memorandum on the Government Garden of Ootacamund* by H. CLEGHORN, *Supt. Botanical Gardens.*

Preservation of Timber.

The Permanent Way Company, 26 Great George Street, Westminster, are employing with success Dr. Boucherie's method of preserving timber. Solutions of preservative substances are introduced by the patent process into various kinds of timber, in such a way as to expel the fermentescible sap, and substitute matter less liable to undergo destructive changes. It has been found that sulphate of copper, dissolved in the proportion of at least 2¼ lbs. to 22 gallons of water, is the best preservative. It is said that white pine thus impregnated with sulphate of copper, placed in the ground as railway sleepers, or exposed to the action of the air, lasts longer than oak unprepared placed in the same situations. The Directors of the Chemin de Fer du Nord state, that Dr. Boucherie's process has produced most satisfactory results as regards sleepers when completely prepared. Those in use since 1846 were as good in 1855 as when laid down. The sleepers are Beech, Hornbeam, Birch, and Pine. The posts for the telegraphic wires prepared by this process, have also shown great durability. The process thus appears to impart durability to woods which are cheap and abundant.—*Edinburgh Philosophical Journal, April* 1857.

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Height of the Himalayas.

It appears from a late survey made of the Himalaya range, by Colonel Waugh, that the Khanchinjinga, which has been hitherto supposed to be the highest summit, is in fact not so—a higher mountain having been discovered, situated between Katamandoo and Khanchinjinga. This last named is 28,156 feet above the level of the sea; but the new summit reaches the enormous height of 29,002 feet. It has been proposed to call this Mount Everest, after a former surveyor-general of India.—*Ibid.*

Effects of the sting of Scorpions.

Mr. Westwood communicated an extract from a letter of a correspondent in India relative to the effects of a sting of a Scorpion. It is described as very severe, resembling the pain of a dozen wasp stings concentrated in the same spot. The finger began to swell, and the whole arm pained excessively, with a feeling of sickness. Ipecacuanha powder was applied, in the form of a paste, to the sting, and brandy and water taken liberally. A native doctor, on being sent for, after rubbing the arm, at length suggested a native remedy, namely a small pan of live charcoal, upon which were occasionally, as they melted, thrown pieces of wax, the smoke from which was allowed to arise over the wound, and which allayed the pain to such a degree that in about an hour and a half the patient was able to smoke. The stung finger was still insensible to the touch and very much swollen, the arm cold as ice, although it had been rubbed for two hours, whilst the sound hand and arm were hot. More brandy and water, with cigars were tried. The patient fell into a long sleep, and awoke next morning with but slight remains of the pain of the sting.—*Zoologist*, 5642.

How to get rid of Musquitos.

Mr. Fortune exhibited samples of the article known as "musquito tobacco" in China. He stated the composition to be the sawdust of pine and juniper, with the powdered roots of a species of Artemisia and a small quantity of Arsenic. These are formed into

a paste, and coated over slender sticks, of about two feet in length, which are burnt as candles and never fail in driving the musquitos from the room. Mr. Fortune added that the Artemisia, which is a species growing wild on the Chinese hills, is employed to fumigate bee-hives, in order to take the honey without killing the bees. —*Zoologist*, 5644.

The Mulberry-tree with reference to the culture of Silk.

The art of rearing silk worms for the sake of the thread spun by them had its origin we believe in China. About the 6th century it was introduced into Greece, from whence several centuries afterwards it was carried into Sicily and found its way thence into Italy and Europe. It is now carried on very successfully in many countries but particularly in the South of France, Italy and Spain. East Indian silk comes chiefly from Bengal and is inferior in quality to both China and Europe produce. It is also made to some extent in Mysore, Cuddapah, Pondicherry and various parts of the Dekhan.

As the mulberry tree plays an important part in the process of silk manufacture, the following extract of a letter from the correspondent of the *Times*, dated PARIS 22d June, 1857, is inserted as bearing on the conditions under which the culture of silk is most successfully prosecuted, and pointing to the advantage which might attend an experiment on some of the more elevated hill-tracts of India, as the Nilagiris, Baba Booden, Pulney, Bella Rungan and other ranges, where we believe it has never been tried.

"The silk crop is sufficiently advanced in the south of France for the growers to be certain that it will be more productive than last year. M. Dumas, who was commissioned by the Academy of Sciences to investigate the causes of the disease which destroyed so many silkworms last year, and to discover a means of removing it, proceeded to Alais last month for the purpose of minutely examining the state of matters. He has since communicated to the Academy the results of his observations. M. Dumas has discovered that all the reports relative to the leaves of the mulberry trees being diseased are unfounded. The leaves throughout the south this year are splendid, and where the eggs are sound the results have

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been most satisfactory. M. Dumas states that the eggs produced in France, Spain, Piedmont, and Lombardy have in general failed, as well as many of those imported from the East, but it is suspected that the latter were produced in infected countries and sent to the East to be sold as if produced there. The eggs from Adrianople, Lebanon, and the Roman States were remarkably successful. Whenever M. Dumas could ascertain the origin of the sound eggs he universally found that they were produced in a mountainous country—that is, in pure air frequently renewed, and that the silkworms were fed on mulberry trees grown in elevated situations. One fact demonstrates what influence an elevated situation exercises on the health of the silkworm. M. Dumas found an intelligent breeder of silkworms, named Etienne, living on the small mountain of St. Germain, near Alais. Four years since he used eggs brought from Italy, and his success was complete. While all the silkworms bred in the low grounds died, he again succeeded, and even last year he produced a quantity of eggs sufficient for himself and for several other breeders. His success and that of the other breeders who made use of his eggs was so great that at this moment the entire country is astonished at it. M. Dumas says, in conclusion, that this year the breeders have tried every description of egg and every system. They were favoured by admirable spring weather and faultless mulberry leaves. It may be expected, therefore, that next year, if the weather should prove favourable, the experience now gained will enable the breeders to resume the course of their ancient prosperity."

The Volvox Globator.

In illustration of Mr. Bidie's paper in the present No. on the connection between the animal and the plant, we observe by recent No. of the Journal of the Microscopical Society that the well known animalcule—the *Volvox globator*—which has always hitherto been classed among the INFUSORIA is now proved to belong to the Vegetable kingdom.

In fact the limit between these two great divisions of organised forms appears to be indefinable. It has certainly not yet been discovered although many attempts have been to prescribe the exact boundary that separates them.

The earlier physiologists considered that such a limit was obtained by the presence or absence in the organism of a power of

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spontaneous *motion* or more properly *locomotion.* But this was soon seen to be insufficient for most of the *Polypes* and some of the *Echinodermata;* all *Cirripedes;* and even some of the higher orders—the *Serpula* among ARTICULATA and the Oyster among MOLLUSCS are fixed to the rocks on which they grow.

On the other hand the *Spores* of many ALGŒ is of *Vaucheria* and of the *Sponges* have a very rapid locomotion.

The next distinction attempted to be drawn was taken from the mode of deriving nourishment, "plants" it was said "absorbing "nutriment by means of fibres at the lower extremity of the body, "animals by an opening (or mouth) at the upper end, conducting "to a capacious sac" (or stomach.)

But the *Gregarina,* a genus of microscopic parasites infesting gregariously the intestinal canals of insects, worms, &c. and several of the free INFUSORIA have neither mouth nor stomach and there is no stomach in *Cestoidea* one of the larger ENTOZOA. They are supposed to derive nutriment by absorption through the skin.

A third characteristic was supposed to have been found in the faculty possessed by plants of exhaling oxygen whilst animals expire carbonic acid. But here too the distinction fails; some of the free moving *Polygastria* eliminate pure oxygen in one stage of their existence while *Mushrooms* and *Sponges* have been found to give out pure carbonic acid gas.

Another chemical distinction it was thought had been discovered in the quaternary composition of animals which are resolvable into carbon, oxygen, hydrogen and nitrogen, whereas owing to the absence of the last mentioned element, the constitution of plants is ternary. *Cellulose* indeed is a binary compound of carbon and hydrogen only. But neither does this definition hold. Nitrogen is found in *Algœ, Fungi* and most cryptogamous plants. And on the other hand, the mantle of *Frustulia* a mouthless *Polygastria* and the thick cellular coat of *Ascidia* are binary compounds. Mr. Bidie has shown that there is reason to suppose the same binary constitution is not unknown among the highest order of animal existence, in the brain of MAMMALIA.

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Some writers have maintained that the green coloring fluid which circulates round the cells of plants under the name of *Chlorophyll* was peculiar to vegetable productions only, but it occurs likewise in green *Planariœ* and in fresh water *Polypes.* With more reason the presence of starch has been thought to indicate a vegetable origin. But the test is not infallible. Others have supposed the power of continuing their race by voluntary division to be a distinctive function of the lower order of animals endowed with locomotion. But red snow and the yeast plant (*Torula*) are propagated by spontaneous fission and in many of the simple ALGŒ the cells elongate and divide themselves to form new individuals.

Hence it appears that a line of demarcation between these two great divisions of created existence has still to be discovered. Nay some have asserted the existence of organised bodies in an animal state at one period of their lives and in a vegetable one afterwards. This view, first started by Bory de St. Vincent, has more recently been revived by Kützing who gives an elaborate description in his work on the ALGŒ of an organism which he calls the *Ulothrix Zonara,* the young of what are propagated in the form of minute animalculæ which he declares he has detected in the cells of the plant and which afterwards become vegetable threads or lines and give out a new series, of animal offspring! The views of the most recent writers on the particular example cited below appear however to be still divided. In a recent work of that most distinguished of living physiologists, Professor Owen,* the *Volvox globator* retains its place among the *Polygastria* at the lowest extremity of animal life, whilst the following extract shows that, more careful observations are considered to have established its place among the ALGŒ in the vegetable kingdom.

" In a paper cently read before the Academy of Sciences in Paris, Professor COHN states that his own observations on the *Volvocineœ* have convinced him that the members of that family must be regarded as belonging to the vegetable kingdom, and that the *Volvox globator* in particular, is properly placed among the ALGŒ. In this singular plant, as well as in *Eudorina, Gonium. Stephanosph*

* Lectures on Animals without Vertebræ, 1855.

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æra, and the other *Volvocineæ,* each spherurle is, propely speaking, not so much an individual as an association or family of individuals a sort of vegetable polypary."

"The globe of *Volvox* is formed at its periphery of an infinitude of very minute hexagonal cells attached to each other in the same way as are the elements of an epidermic tissue. Each of the cells is furnished with two motile cilia and may be compared with a *Chlamydococcus.* The green endochrome is suspended as it were, in the cavity, being connected with the wall only by means of filiform processes.

"Like all the ALGŒ, the *Volvocineæ* present two distinct modes of reproduction; but up to the present time naturalists have been acquainted with only one of these, consisting in the repeated segmentation of the constituent cells, and resembling the fissiparity of *Chlamydococcus* and *Gonium,* or that of most of the *Palmellaceæ.*

"The second mode of reproduction of *Volvox* requires a sexual conjunction and is not observed indifferently in all individuals. The spherules endowed with the sexual function, are distinguished by their volume and the more considerable number of their component utricles; they are generally monœcious that is to say they enclose at the same time male and female cells although the majority of their contents are neuter. The female cells soon exceed their neighbours in size, assume a deeper green colour, and become elongated like a matrass towards the centre of the *Volvox.* The endochrome of these cells does not undergo fission. In the other cells on the contrary, which acquire the size and form of the female cells, the green plasma may be seen to divide symmetrically into an infinity of very minute particles or linear corpuscles, associated into discoid bundles. These are furnished with vibratile cilia, and oscillate, at first slowly in their prism, but the movement soon becomes more active, and the bundles speedily break up into their constituent elements. The free corpuscles are very agile, and it is impossible to regard them as anything but true spermatozoids; they are linear and thickened at the posterior extremity: two long cilia are placed behind their middle, and the rostrum which is curved like the neck of a swan possesses sufficient con-

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tractibility to execute the most varied movements. These spermatozoids so soon as they are able to disperse themselves in the cavity of the *Volvox,* quickly crowd around the female cells into which they eventually penetrate; arrived there, they attach themselves by the beak to the plastic globule, destined in each cell to form a spore, and with which they are gradually incorporated. Fecundation having been thus effected, the reproductive globule becomes enveloped successively by an integument exhibiting conical pointed eminences and by an interior smooth membrane; the *chlorophyll* which it contained is now replaced by starch grains and a red or orange coloured oil. This is the condition of the spore at maturity and occasionally forty of these bodies may be counted in a single globe of *Volvox.* The germination of these reproductive bodies has not yet been observed, so that their history cannot be regarded as complete: but from analogy it may, in the meanwhile, be assumed that they germinate in the same way as do the spores of *Ædogonium Sphœroplea,* and other ALGŒ belonging to the same order. It may be maintained moreover, as certain that the *Sphœrosira volvox,* Ehr., is nothing else than a monœcious *Volvox globator;* that his *Volvox stellatus* is also *V. globator,* observed at the time when it is filled with stellate spores, and, lastly, that the *V. aureus* of the same author differs from the other forms of the same species, simply in the smooth [and coloured] condition of the spores."—*Journal Microscop. Society, Vol.* V, *page* 149, *No.* XIX *for* 1857.

It must be added that Professor COHN is by no means the first discoverer of the true nature of the *Volvocinœ.*

At the meeting of the Microscopic Society of London on the 26th May 1852 a paper on "the structure and development of *Volvox globator* and its relations to other unicellular plants" was read by Mr. GEORGE BUSK, F. R. S. followed by a copious Appendix in the Oct. of the same year. Between which Professor Williamson also submitted a paper on "the farther elucidation of the structure of *V. globator*" at the meeting of the 21st June. These papers which go into the subject at great length are of too technical a character to suit the purpose of this Journal.

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NOTICES OF BOOKS.

Oriental.

SALAMAN AND ABSAL, *an Allegory translated from the Persian of Jami.* London, 1856, in 8vo. XVI. et 84 pages.

The *Journal Asiatique* for February and March 1857, No. 34, announces the publication of the above poem in English blank verse, and says of the translator :—

"He is a pupil of M'Cowel, the Editor of the *Grammaire pracrite de Vararuchi,* a favorite with men of letters generally and especially with the friends of Persian literature with the translation of which he occupies himself. We know that in the greater part of Persian Poems the narrative is interspersed with anecdotes intended to place in relief the opinions the author; but these do not detach themselves sufficiently from the original text, and a certain obscurity sometimes arises thereby. The author of the translation has remedied this inconvenience by putting the anecdotes into shorter verses, and by using italics so as to distinguish them entirely from the principal narrative and to permit the reader to pass them over, should he so choose, without losing the thread of the story. * * * * Jami was born at the commencement of the 15th century, and lived 81 years. He was already an old man, when he wrote *Salaman o Absal* and he complains in the introduction of his poem, "that his 2 eyes were no longer of any use to him, and that European spectacles had not given him four eyes"*

A new Persian grammar is announced by Mr. A. H. Bleeck under the title of a *A Concise Grammar of the Persian Language* (Quaritch). It is a small but useful work, and to the great majority of students, who do not pretend to acquire more than a fair knowledge of Persian, it will be found preferable to the large voluminous dictionary of Mirza Ibrahim and others. Mr. Bleeck has given a brief notice of Persian literature in the preface to his grammar, and a list of books which he recommends to the attention of beginners.

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* The translator by the substitution of one word for another has rendered the reading.

* * * "My two eyes see no more
Till by Feringhe glasses turned to four."

Natural History.

Flora Algeria.—M. Corson is continuing to publish his Flora of Algeria, and is about to take a 4th Botanical trip into that country. He proposes to examine the numerous cases of the so called desert of Sahara. On the mountains of Atlas at each journey species have been discovered which were supposed to be peculiar to Egypt or Arabic.—*Ed. Phil. Jour. April* 1857.

American Oology.—"We have in the press the first part of Dr. Brewer's great work on *American Oology.* It will include the rapacious birds, and perhaps the swallows. There will be five quarto plates to this part, all the figures taken in photograph, from the original eggs, and printed in colors. The result is extremely beautiful and accurate."—(*Letter from Dr. Bird, Smithsonian institute, Washington.*)—*Ed. Phil. Jour. April* 1857.

Mr. F. Moore communicated a paper '*On the habits of some birds observed in the plains of N. W. India* in 1849,' by the Rev. T. Philipps, Baptist Missionary. The names of the birds described in this paper (sixty in number) had been determined by comparison with specimens in the Museum of the Hon. East India Company.

Mr. Moore read a paper containing descriptions of some new species of Lepidopterous insects from Northern India, characterized as follows:—*Pieris Nama,* E. Doubleday, M. S., *P. Seta,*, Moore; *P. Sanaca,* Moore; *P. Indra,* Moore; *P. Durvasa,* Moore; and *Papilio Janaka,* Moore.—D. W. M.

Miscellaneous.

Glimpses of Life and Manners in Persia, by Lady Sheil, London, 1857, in 8vo. (402 pages.)

This book is thus noticed in the *Journal Asiatique* for April—May 1857, and we have much pleasure in endorsing the reviewer's opinions upon it, who informs us that,—

"Lady Sheil accompanied her husband Colonel Sheil, during his embassy in Persia and passed 3 ½ years in the country, principally at Teheran; she made once a voyage to Ispahan and passed a summer in the mountains of Mazenderan. An elegant accomplished lady, she took the trouble to learn to speak Persian, and she communicates to us, in an agreeable and unpretending manner, her observations on the manners and customs of the country, and on every thing that she had an opportunity of

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seeing satisfactorily. The Colonel has added to his wife's Journal a series of detailed and very instructive notes on the ruins of ANI, on the Koords, the Turcomans, the Nestorians; on Khiva, on Affghanistan, on the silk manufactures of Persia, on the Persian army, on the Revenue of the country, and on the Nomadic tribes of whom he gives a nominal and numerical list. These notes have a real value, as Colonel Sheil knows Persia well; he has lived there for 21 years, as Military Instructor, Colonel of a Regiment and finally as Ambassador. It is a pity that he has not gone into more detail in these notes, especially those which refer to the Nomadic tribes, concerning whom we have still but little information, while their study is extremely interesting from many points of view.

After the same manner also the Vicountess Falkland has given to the world a selection from her Oriental observations, in the form of a book entitled *Chouchow; being selections from a Journal kept in India, Egypt, and Syria.* 2 vols. (Hunt and Blackett.) The name at first sight is not a very inviting one, but the book improves upon acquaintance and contains a narrative of many amusing scenes. Lady Falkland accompanied her husband (Lord Falkland) in 1848, when he was made Governor of Bombay, and the work under notice is a pleasant *precis* of her personal experiences in the East. It is not a volume demanding much attention, but at the same time, is pleasantly written and for light reading is attractive and interesting.

The list of new works for September, includes a work entitled,—*British India, its History, Topography, Government, Commerce, &c.* By R. M. MARTIN. 1 vol. imp. 8vo. cloth, price 21s.

Also a little volume on "India" generally, by Mr. Stocqueler, and entitled *India.* (Foolscap 8vo. boards, price 1s. 6d.)

Mrs. Young who is a great admirer of everything Indian has added to her oriental sketches a book entitled *The Moslem Noble: his land and people; with some notices of the Parsees or Ancient Persians.* (Saunder's and Ottley.) The *Athenæum* does not review it very favorably, and thinks it will add little to her reputation.

Another contribution to our knowledge of Mahomedan life and manners, appeared about the same time as Mrs. Young's book, en-

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titled *Autobiography of Lutfullah, a Mahomedan gentleman; and his transactions with his fellow creatures: interspersed with remarks on the habits, customs, and character of the people with whom he had to deal. Edited by Edward B. Eastwick. (Smith, Elder and Co.)*

The promised "*Memoirs and letters of the late Colonel Armine J. H. Mountain, C. B.*, have at last appeared, edited by Mrs. Armine J. Mountain, his widow. To Military readers the memoirs will have a peculiar interest, as Colonel Mountain was for sometime Adjutant General of the Forces in India, and died at Futtyghur in January, 1854.

The Rev. J. C. Browne, Assistant Chaplain on the Bengal Establishment has written a small work on *Indian Infanticide.* It has been published in England, and is priced 10s. 6d.

Having had opportunities of consulting official and other documents not easily accessible to people generally, Mr. Browne says that he has been enabled to collect information of a valuable nature on this interesting subject.

The Library of the Society has been furnished by Government with a copy of the *Cyclopædia of India and Eastern Asia.* By Edward Balfour, L. R. C. S. E., Surgeon, Madras Army. It is issued in Nos. of 100 pages each. Four Nos. have already appeared, containing in all 2,755 words, which reach as far as C in the Alphabetical arrangement.

Such a work undertaken by one man, and one too engaged upon numerous other duties, however studious and diligent he may be, cannot but contain many imperfections. The author himself is aware of this, but having long felt the want of some portable book of reference on scientific and economic subjects connected with Eastern countries, he has liberally come forward with his services and has laid the foundation stone as it were of a work which is intended to supply that want. There is no question but that his long residence in India, his Scientific researches and his very variety of duties eminently fit him for a work of this character, which however imperfect and incomplete as a whole, will be of great utility, and prove a valuable aid to others who may wish to walk in

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his footsteps. That there will be found such others willing to aid in the good work we feel assured.

As more consonant with the times though of less literary importance, there have been announced within the last month or two;

A new edition of *The Mission the Camp and the Zenana, by* Mrs. Colin MacKenzie, under the title of *Six years in India; Delhi the city of the great Mogul, with an account of the various tribes in Hindoostan, Hindoo, Sikhs Affghans, &c.*.

Our Indian Army; a Military History of the British Empire in the East. By Captain Rafter.

Dacoitee in Excelsis; or the spoliation of Oude by the East India Company.

Whatever the aim may have been of the author of this last mentioned publication, whether to get up a diversion in favor of the Oude Ladies at home, or to stimulate attention to Indian affairs, he could not well have selected a subject more mal-apropos to the present time. Neither he nor his subject will attract much sympathy just now.

The several publications and pamphlets elicited in explanation of the present disastrous mutiny in Bengal are too numerous to mention.

PROCEEDINGS.

The Managing Committee of the Madras Literary Society *and Auxiliary of the Royal Asiatic Society, Thursday evening the 13th of August, and 10th of September,* 1857.

The Honorable Walter Elliot in the Chair.

The usual Financial Statement had been read, it was decided that the Funds were in after a satisfactory state, such as to allow of the Library being stocked with such Standard works on different subjects as in the opinion of the Committee were calculated to complete the different branches of Literature.

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Several specimens of carved wood from Saharunpoor were laid on the table. Dr. Jamieson, the Superintendent of the Botanical Garden at that place, intended that they should have appeared in the Exhibition, together with specimens of the different kinds of Tea grown in the Himalayan Plantations. But the packages having been late in reaching Calcutta, and having been then forwarded in the Ship "Gustave" which took two months after leaving the Sand Heads to reach Madras, the articles did not arrive till long after the Exhibition had closed.

The specimens consisted of Platters, Pen Trays, &c., carved in the beautiful white wood of *Wrightia anti Dysenterica* or the darker timber of species of *Nauclea Doodia*, &c. The designs represent different kinds of foliage, and are generally elegant. Some of them are in considerable relief. The large Platters are sold for 3 Rupees, the Trays for 1 Rupee each, at the place of manufacture.

Mr. Elliot exhibited a series of microscopic drawings of Marine Animalculæ made by Mr. E. M. Wrench of the 12th Lancers, during his voyage from England in the "Gloriana," in the early part of the year.

Mr. E. read a short notice identifying such of the specimens as were depicted with sufficient clearness to exhibit their generic characters.

These were found to be, for the most part minute Crustaceans belonging to the division of Copepods, Milne Edwards, and principally to the Genera of *Pontia* and *Cyclops*.

An Amphipod Crustacean approaching nearly to the Genus *Vibilia* and found in the cavity of a *Diphya* was also conspicuously represented.

Besides these were one or two *Annelides*, minute *Beroes* a very small *Medusa* belonging to the Gerqonidæ, and several remarkable forms apparently of undescribed animals.

Although not represented with sufficient minuteness of detail to allow of more accurate identification, Mr. Wrench's drawings are executed with great spirit and appearance of truth. Mr. E. pro-

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posed that a selection of them should be engraved for publication in the Journal, with a view of showing how large and interesting a field of discovery exists for persons provided with a Microscope, during long voyages. He also proposed in connection with the same subject, that an excellent Memoir on Animalculus and other organized bodies, which give a colour to the Sea, by Camille Dareste, should be re-published among the selections. It appeared originally in the Anneles des Sciences Naturelles, and has been translated for the Edinburgh *New Philosophical Journal.*

The subject was referred to the Committee of Papers.

The Committee have to acknowledge the receipt of the following Papers.

The Study of Living Languages, by Colonel A. Cotton.

Suggestions for Weights and Measures for India, by W. H. Bayley, Esq.

A plan for taking Stereoscopic Portraits with a common Camera, by Lieut. Paxton, *from Dr. Scott.*

The Oxymel Process in Photography, by J. Tawse, Esq.

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DAILY

Date.	June 1857. Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Thermometers. Max.	Thermometers. Min.	Wind.	Rain.	Remarks.	July 1857. Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Thermometers. Max.	Thermometers. Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.		Inches	°	°	°	°		Ins.	
1	29·704	88·0	77·9	102·3	82·2	?	0·009	Hazy	29·723	88·1	75·7	103·2	81·6	s s w	....	Ha
2	·706	88·6	77·4	103·5	81·8	w s w	....	Clear	·722	85·7	76·8	99·1	79·8	s s w	0·060	Clo
3	·716	88·9	78·8	101·6	83·8	s	....	Hazy	·694	87·2	76·9	102·9	81·3	s s w	....	do
4	·709	87·9	78·3	101·3	82·3	s w	....	do				102·8	81·5	?	·006	
5	·740	87·1	78·5	97·9	81·6	s	....	Ovcst.	·693	87·0	76·0	100·3	83·4	w by s	·039	Ovc
6				98·3	83·5	s by w	...		·695	89·7	76·7	102·7	83·2	w s w	....	Clo
7	·750	87·2	79·5	97·3	81·5	s by E	....	Clody.	·718	86·6	77·4	99·4	81·0	s s w	....	do
8	·708	87·5	79·8	99·4	82·4	?	....	Hazy	·739	87·5	77·3	101·4	82·8	s w	·123	Ha
9	·687	86·9	79·6	98·4	76·9	s	....	Clody.	·747	87·1	77·5	101·1	82·2	s w	....	Ove
10	·723	83·0	78·2	89·8	76·7	?	1·770	do	·711	86·5	77·4	99·7	81·3	s s w	....	Clo
11	·740	82·8	78·2	94·2	78·6	w	0·325	do				99·3	78·5	s s w	·003	
12	·656	85·6	78·1	100·4	79·1	w s w	....	do	·704	85·7	77·0	100·2	80·9	w s w	·570	Cl
13				98·7	79·2	s w	....		·713	87·2	76·7	99·7	82·6	w s w	·010	d
14	·691	81·7	76·9	86·9	79·6	w	·220	Ovcst.	·694	87·9	75·8	100·8	81·4	w s w	....	Ha
15	·706	82·4	77·2	93·7	79·0	w	...	do	·670	87·7	76·0	98·3	82·6	w s w	....	Cl
16	·673	83·6	76·2	94·7	79·0	w s w	...	do	·660	86·8	76·9	99·8	81·9	s w	...	Or
17	·684	84·1	75·2	95·4	79·4	w	....	do	·674	86·7	77·3	99·0	81·2	s w	..	Cl
18	·707	85·0	76·1	98·1	78·8	w s w	....	Clody.				97·0	82·0	s by w	·010	
19	·694	86·1	76·9	100·3	81·1	w	·100	do	·720	86·7	78·0	98·6	81·8	s	....	Cl
20				98·0	80·5	w s w	·056		·737	86·2	78·3	100·7	80·3	s s w	....	d
21	·666	85·4	76·4	99·7	80·5	w	·024	Ovcst.	·750	83·8	77·4	95·1	77·8	s s w	·007	O
22	·661	85·2	75·5	91·4	81·3	w by s	·034	do	·752	83·7	77·7	95·7	76·2	w s w	·006	C
23	·714	87.7	76·2	101·6	80·2	w s w	....	Clody.	·760	83·7	77·5	94·2	80·2	s w	·199	d
24	·734	88·0	77·4	102·1	80·9	s w	....	Hazy	·766	84·7	78·0	97·5	79·1	s s w	·030	d
25	·731	88·8	77·3	102·9	83·8	w	....	do				96·0	79·0	s	....	
26	·753	85·4	77·3	100·5	80·8	s w	·330	Clody.	·748	80.7	76·3	84·8	76·7	?	....	O
27				100·9	80·3	w s w	....		·773	77·6	74·4	87·1	74·1	w	·890	d
28	·736	84·5	76·3	95·2	82·0	w s w	·025	Ovcst	·772	79·5	74·5	89·6	76·0	w s w	·172	d
29	·733	86·7	74·9	102·1	80·3	w by s	·047	Clody.	·709	79·7	75·1	93·4	77·0	w s w	·021	d
30	·740	88·7	75·0	97·4	82·6	w		do	·670	81·8	75·3	94·4	77·6	s w	·095	d
31									·707	81·6	75·2	91·1	77·6	w	·029	d
Mean.	29·710	86·0	77·3	98·1	80·7		2·940 Sum		29·719	85·1	76·6	97·6	80·1		2·270 Sum	

? This mark signifies that no Means can be

MEANS.

August 1857									September 1857.									
32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.		Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.	Date.
ies	°	°	°	°		Ins.			Inches	°	°	°	°		Ins.		
			96 4	78·1	w s w	0·122			29·798	85 9	78·0	95·9	82·2	s s E	....	Clody.	1
64	83 5	77·1	95·3	79·1	w s w	·010	Ovcst.		·795	86·0	77·9	96·1	83·5	s by E	....	do	2
02	84 8	77·9	97 9	80·2	s w	·232	Clody.		·785	86·9	77·3	98·4	82 7	s w	....	do	3
74	85·1	77·6	97·7	80·1	s s w	....	do		·783	86·1	77 6	96·3	81 6	s s E	....	do	4
67	85·2	77·5	97·9	80·0	s w	....	Ovcst.					96 0	81·0	s s E	....		5
71	86·3	77·4	100·9	81·6	s w	....	Clody.		·766	86 6	77·4	99·7	81 4	s by w	....	do	6
53	85·9	76 7	100·0	81·3	w s w	·060	do		·756	87·1	77·2	100·9	82 3	s w	....	do	7
			98·8	81·7	w s w	....			·779	87·0	76·6	101 1	83·0	s w	....	Ovcst.	8
743	87·5	75·5	100·9	81·2	w s w	....	do		·768	87·0	75 9	99·6	83·0	s w	....	do	9
719	87.8	73·9	100·0	80·7	w s w	....	do		·796	85·5	75·1	95·9	79·6	?	....	Hazy	10
718	85·9	76·1	99·8	81·2	s w	....	Ovcst.		·824	85·6	76 7	94·8	80·8	s	....	do	11
718	86·4	76·2	101·8	80·7	?	·010	Clody.					99 1	80·8	s s w	...		12
709	85·5	77·0	99·8	80·1	s w	·050	do		·798	85 9	76·2	98·5	82·9	w by s	0·003	Clody.	13
742	88·0	74.7	99·5	82·4	w by N	·192	Ovcst.		·818	82·8	75·9	96·6	78·5	w s w	....	Ovcst.	14
			98·7	83·6	w by s	....			·828	82·3	76·1	88·9	79·5	w	·290	do	15
713	89·0	74·7	101·3	83 9	?	....	do		·775	82·7	75·9	92.2	79·3	w s w	....	do	16
708	87·5	75·4	100·1	82·4	w	....	Clody.		·729	82·0	75·3	89·9	78·6	w	·310	do	17
737	84·9	75·7	95 9	81.6	w	...	Ovcst.		·738	84·6	75·5	97·2	81·2	w	·220	do	18
741	86·7	75·8	101 0	82 6	s w	·130	do					98·0	79·7	w by s	..		19
744	85·5	76·1	100·4	80·8	s w	...	Clody.		·824	83·5	77·1	92·7	79·0	s s w	....	do	20
750	85·0	75 9	99·8	80·3	w N w	·012	Hazy		·872	83·5	77·8	92·8	80·2	?	·022	Clody.	21
			96·2	79·4	s w	·040			·895	83·1	78·5	91·2	80·7	s by E	....	Hazy	22
789	84·4	76·4	97·6	81·0	w by s	.124	Clody.		·885	84 3	78 5	94·7	80·7	s s E	.080	do	23
787	84·7	77·3	96·9	78 8	s by w	...	Clear		·895	84·5	77 8	94·5	80·4	s	....	do	24
776	85·5	76 9	101·0	79·4	w s w	....	Clody.		·900	85·3	78·5	96·5	81·2	s w	...	do	25
775	86·7	76·2	99 5	82·3	w s w	...	Hazy					96·2	78·6	w s w	....		26
07	85·7	76·4	97·8	81·2	w s w	...	Clody.		·851	84·4	76 9	96·2	79·0	w by s	....	Clody.	27
09	86·3	76·2	101·1	80·2	w	·049	Hazy		·845	83·3	76·6	96 2	77 1	w s w	·135	Hazy	28
			101·5	82·3	w	....			·847	85·0	78·0	95·8	78·7	?	....	Clody.	29
779	86·7	75·2	98·9	81 6	s s w	....	Clody.		·836	82·9	75·7	96·9	77·5	w by s	·340	do	30
778	86 5	76·1	100·2	83·1	w s w	·015	do										31
757	86·0	76·2	99·2	81·1		1·046 Sum			29·815	84·8	76·9	96·0	80·5		1·400 Sum		Mean.

taken owing to the variable state of the Wind.

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Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen Mean Time	Noon	1	2	3	4	5	6	7	8	9	10	11
Madras Mean Time	h m P.M. 4 41	h m 5 41	h m 6 41	h m 7 41	h m 8 41	h m 9 41	h m 10 41	h m 11 41	h m 12 41	h m 13 41	h m 14 41	h m 15 41
										*		*
Bar. at 32° Far. 1857	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
June	29·637	29·653	29·678	29·702	29·721	29·738	29·743	29·735	29·722	29·708	29·700	29·696
July	·648	·665	687	·712	·731	·749	·857	·747	·731	·722	·715	·713
Aug	·677	·690	·708	·736	·769	·787	·788	·780	·768	·760	·755	·756
Sep.	·745	·762	·783	·886	·827	·846	·848	·839	·826	·814	·806	·804
Dry Ther. 1857	°	°	°	°	°	°	°	°	°	°	°	°
June	90·3	88·5	85·6	84 3	83·7	83·3	82·9	82 5	81·9	81·6	81·3	80·8
July	88·7	86·9	84·9	83 6	83·0	82·4	81·8	81·3	81·0	80·6	80·3	79·9
Aug	89·7	87·2	85·0	83 9	83 5	83·0	82·5	82·1	81·9	81·6	81·3	80·9
Sep.	87·6	85·5	84·1	83·4	82·8	82·4	82·0	81·7	81·4	81·0	80·7	80·4
Wet Ther. 1857												
June	78·8	78·8	78 4	78·1	78 1	77·6	77·4	77·1	76·4	76·2	76·0	75 5
July	78·0	77·9	77·5	77·6	77 5	77·3	76·1	76·8	76·3	75·7	75 1	74·6
Aug	78.0	79 6	77·5	77·5	76 6	76·0	76·6	76 5	76·1	75·6	75 1	74·8
Sep.	78·1	78·0	77·8	77·8	77·7	77·7	77·4	77·3	76·8	76·5	76·3	76·0

Gottingen Mean Time	12	13	14	15	16	17	18	19	20	21	22	23	Means.
Madras Mean Time	h m 16 41	h m 17 41	h m 18 41	h m 19 41	h m 20 41	h m 21 41	h m 22 41	h m 23 41	h m 0 41	h m 1 41	h m 2 41	h m 3 41	
Bar. at 32° Far. 1857	In.	In.	In.	In.	In	In.	In.	In.	In.	In.	In.	In.	In.
June	29·702	29·717	29·736	29·752	29· 65	29·765	29·753	29·729	29·706	29·682	29·659	29·644	29·710
July	·718	·127	·745	·758	·769	·769	·757	·733	·710	·687	·666	·650	·719
Aug	·762	·775	·791	·810	·820	·817	·801	776	·746	·719	·694	·681	·757
Sep.	·813	·825	·845	·865	·877	·874	·858	·832	·800	·771	·752	·742	·815
Dry Ther. 1857	°	°	°	°	°	°	°	°		°	°	°	°
June	80·2	80·0	81·6	84·8	87·1	88.9	90 9	92·2	93·1	93·4	93·3	92·4	86·0
July	79·4	79 4	80·6	83 2	86·0	88·0	90·2	91·9	93·1	92·9	92·1	90·9	85·1
Aug	80·5	80·1	81 5	84·3	86 7	88 9	90·9	93·2	94·9	95·1	94·2	92·0	86 0
Sep.	80·1	79·8	80·7	82·9	85·2	87·7	89·7	91·3	91·6	91·6	91·0	89 5	84·8
Wet Ther. 1857													
June	75·0	74·7	75·2	76 3	77·1	77·6	77·9	78·2	78·3	78 8	78·8	78·8	77·3
July	74·2	73·9	74·4	75·1	76·1	76 5	77·1	77·4	77·8	78 3	78·4	77·9	76 6
Aug	74·4	73·6	74·0	75 0	75·2	75·5	75·8	76·4	77·1	77·6	78·1	78·1	76·2
Sep.	75·7	75·5	75·5	75·8	75·9	76·1	76·2	77·0	77·5	77·5	78·0	78·2	76·9

* The Numbers in these Columns are not observed but interpolated for the sake of obtaining the daily Means.

MADRAS OBSERVATORY,
1st October, 1857.

W. S. JACOB,
Hon'ble Company's Astronomer.

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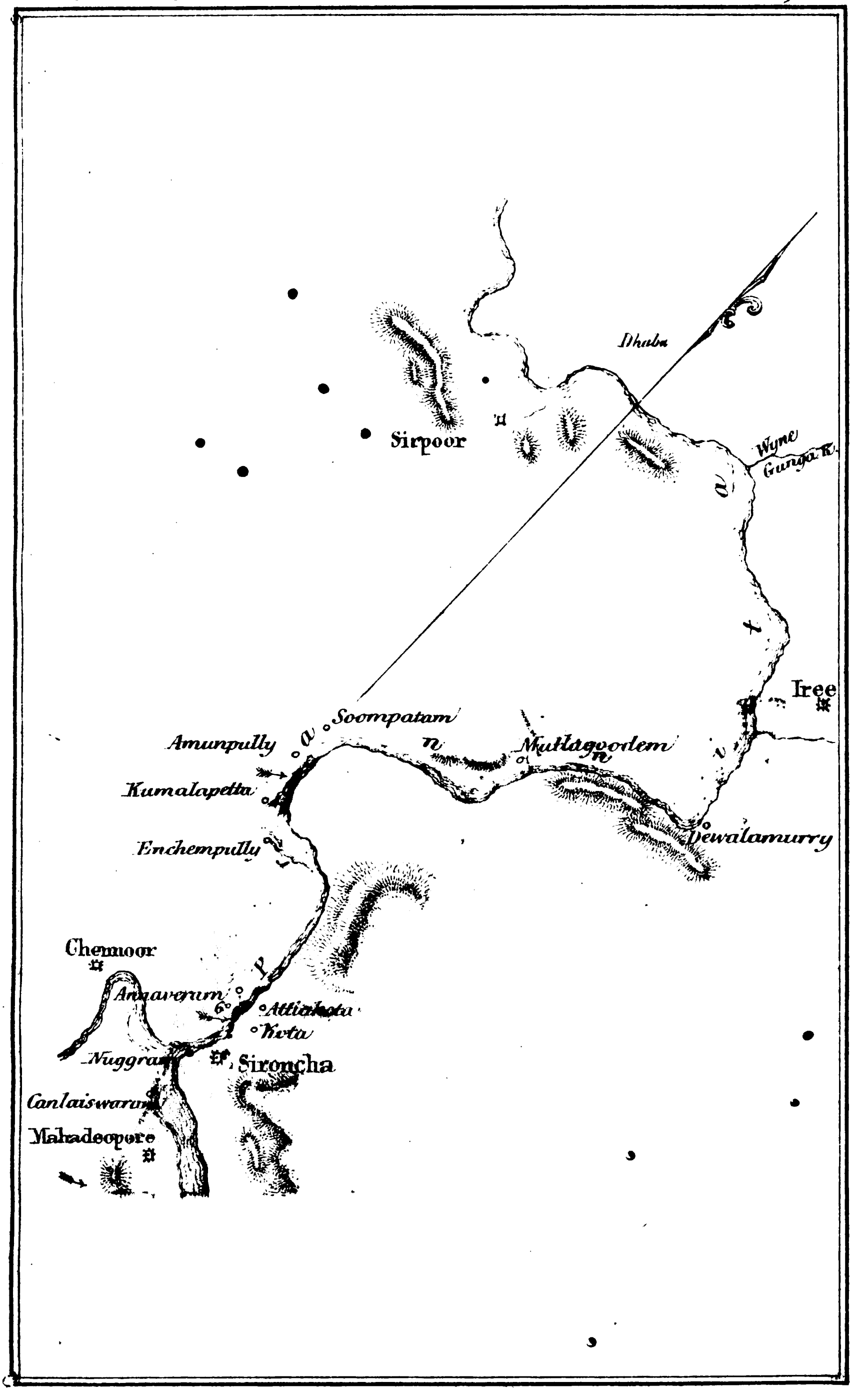
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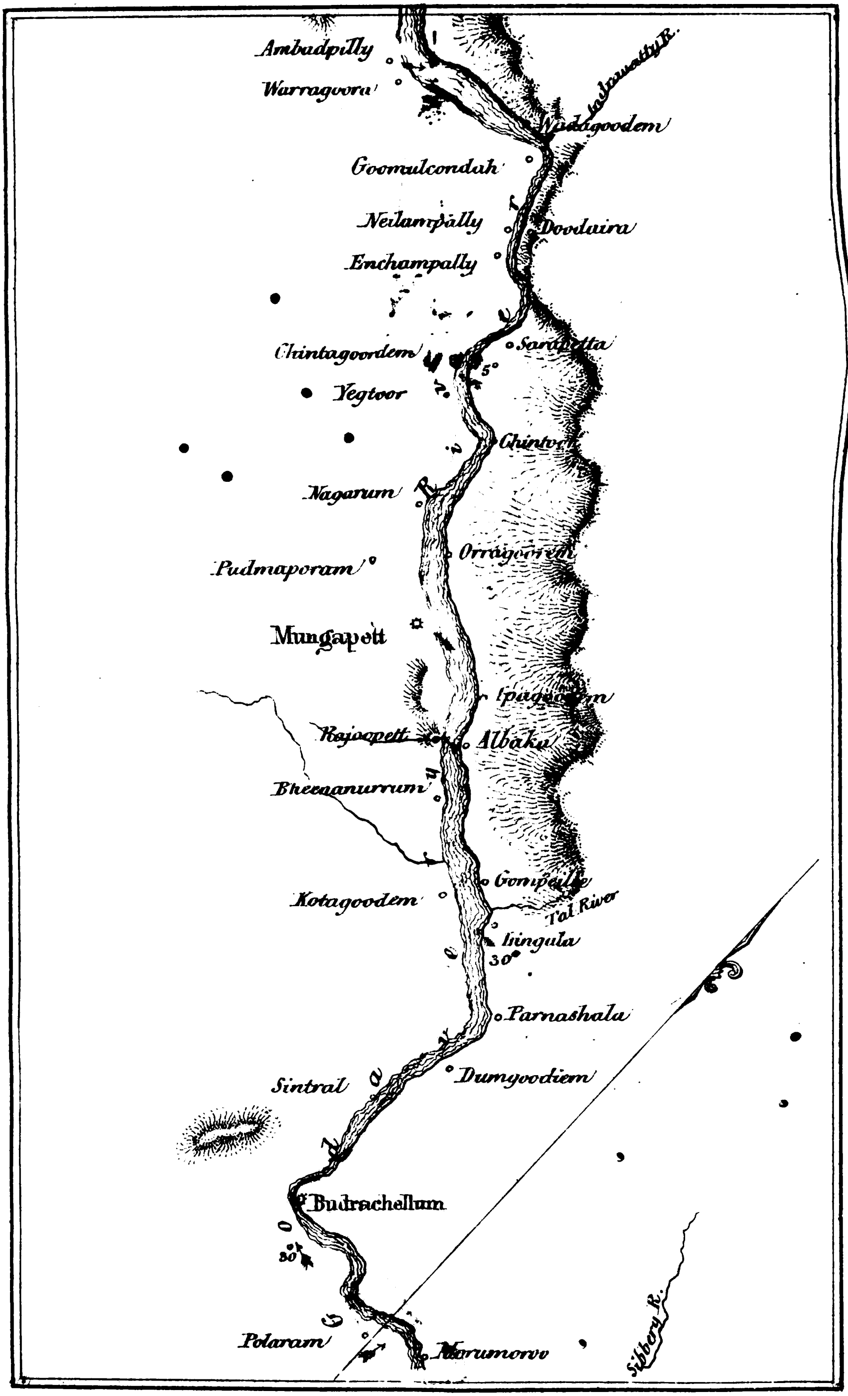

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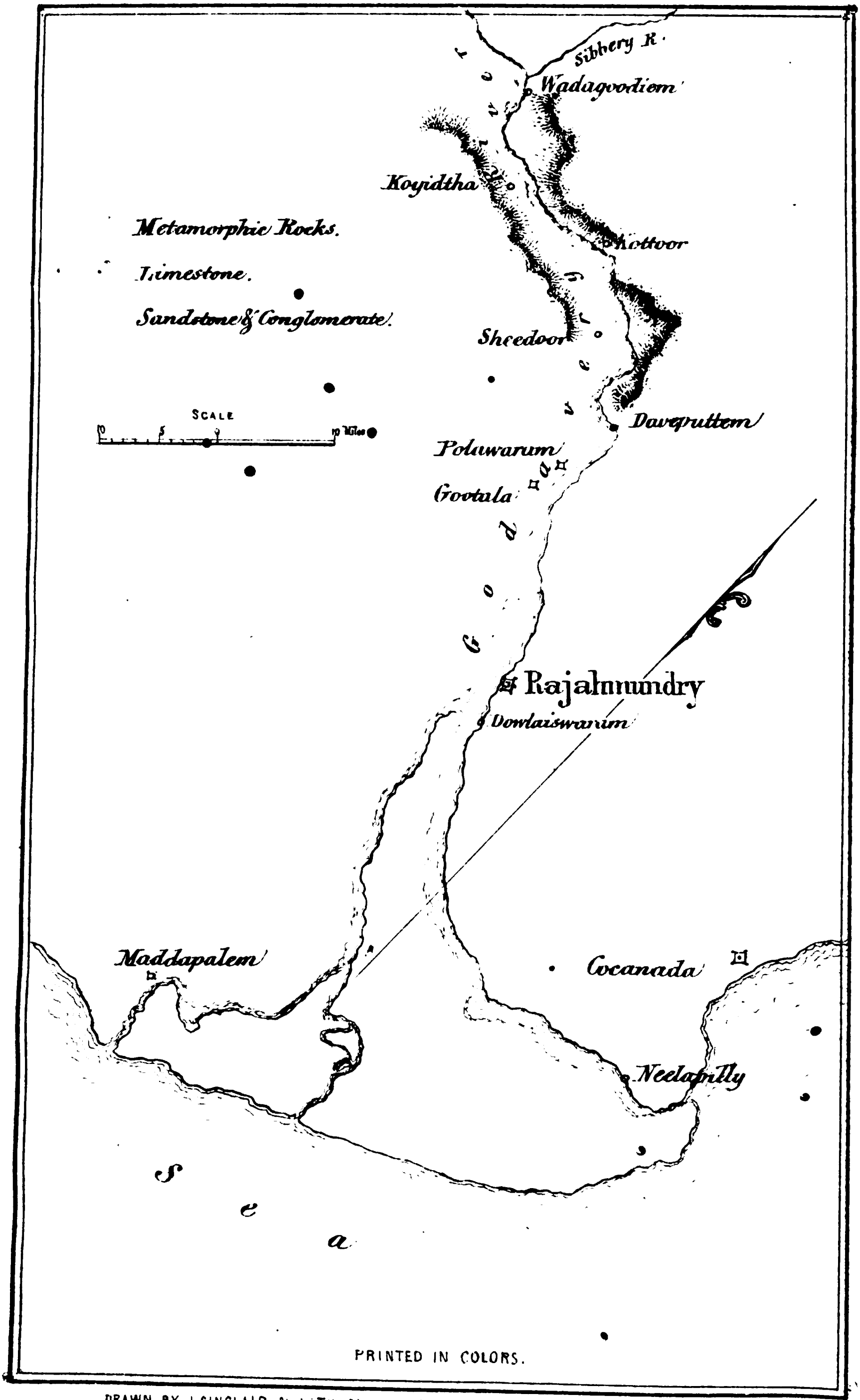

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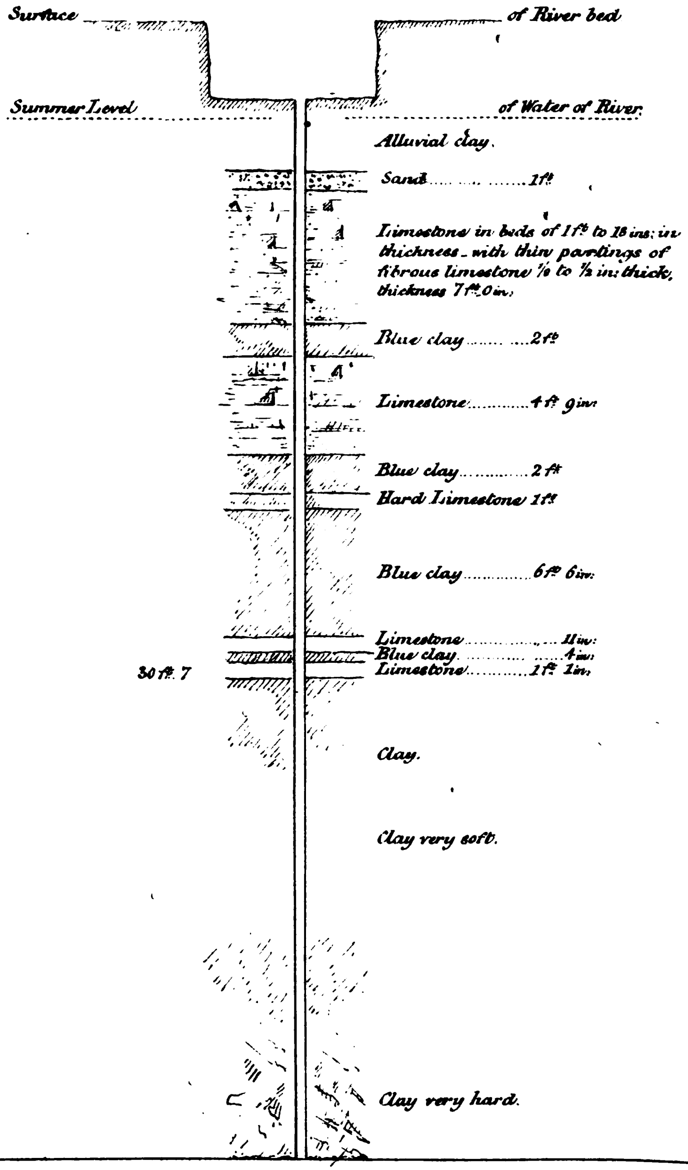

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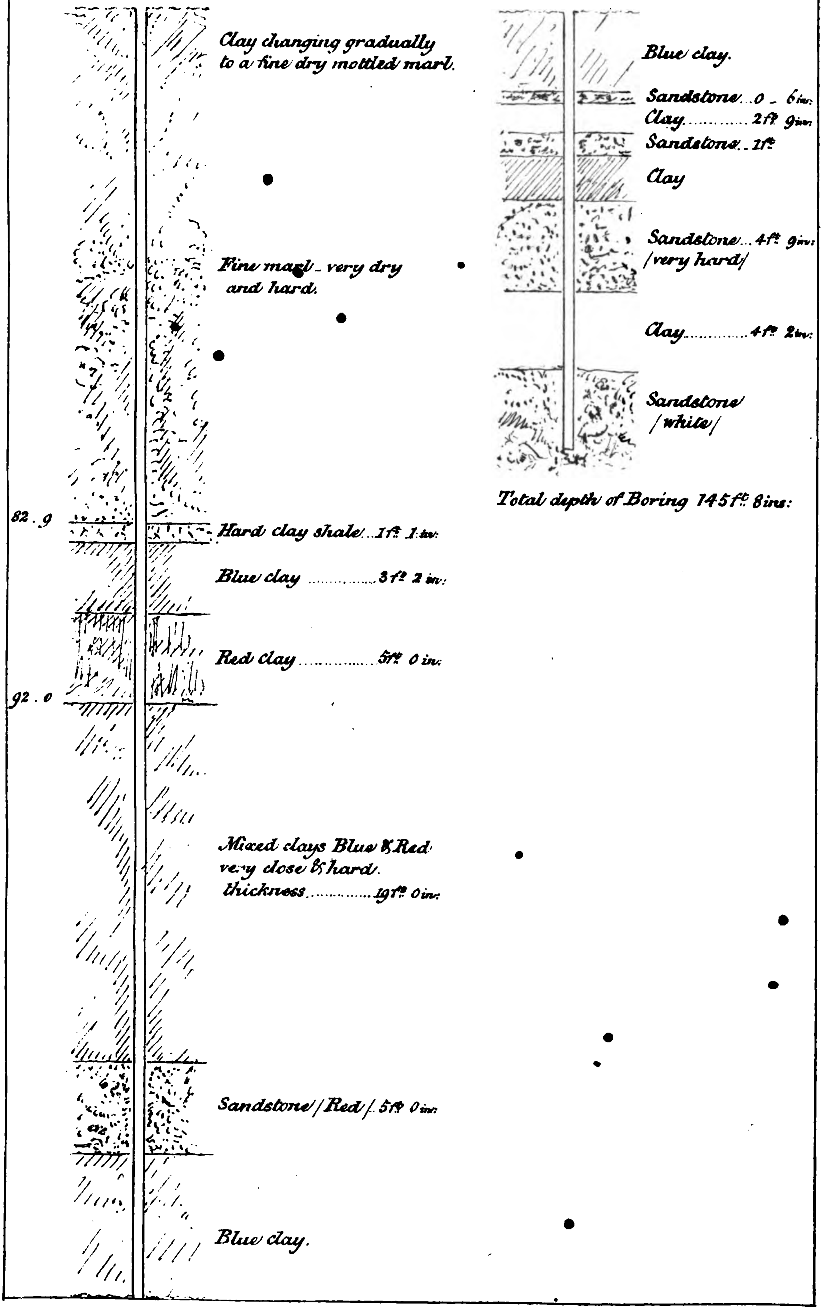

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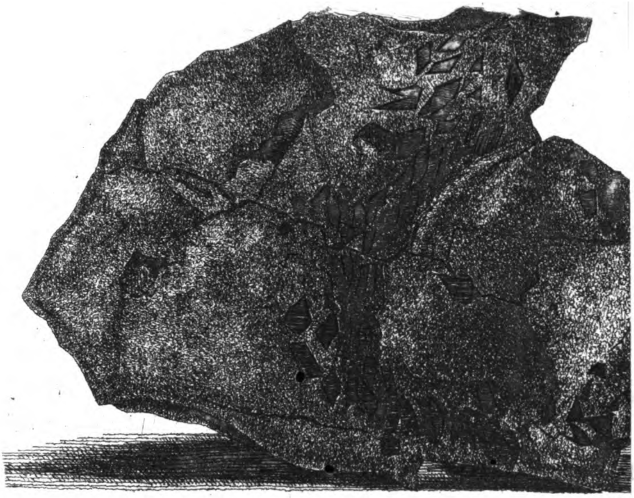

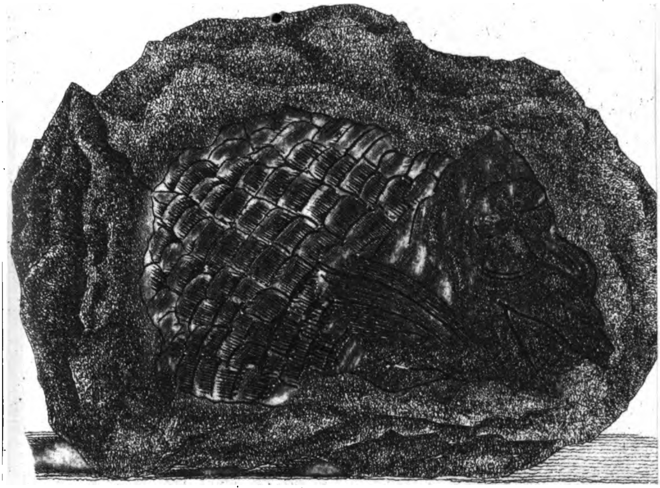

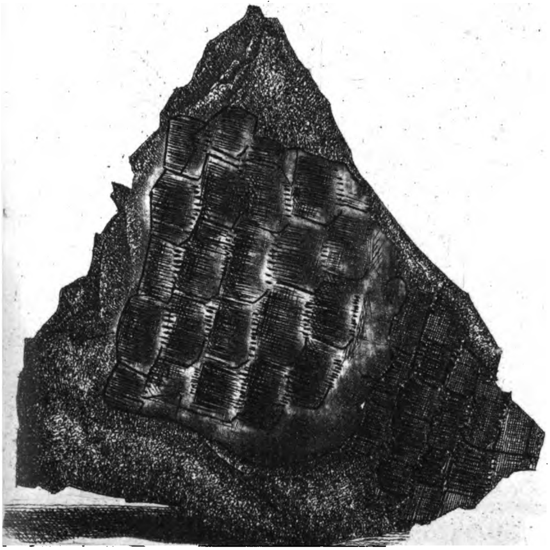

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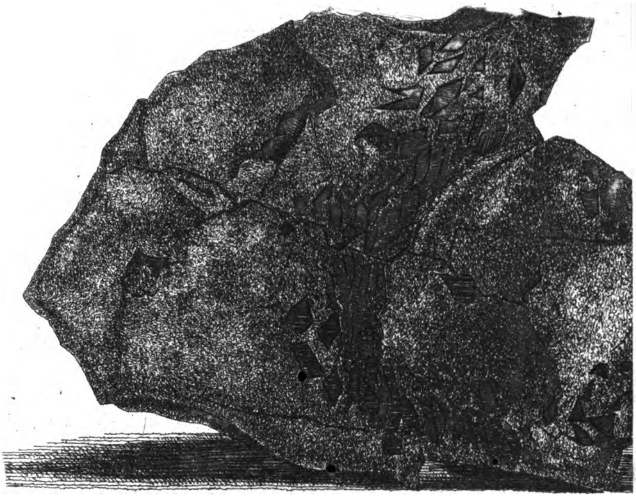

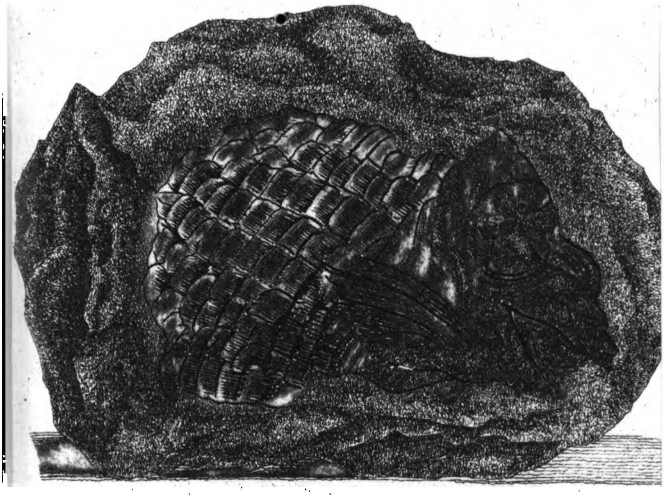

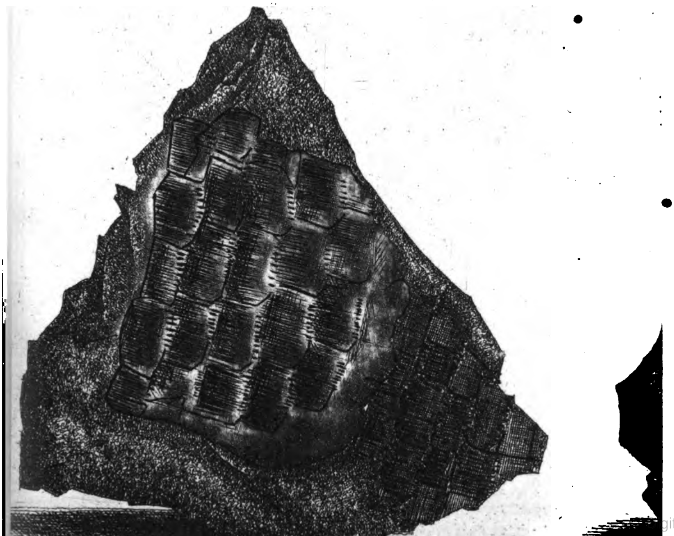

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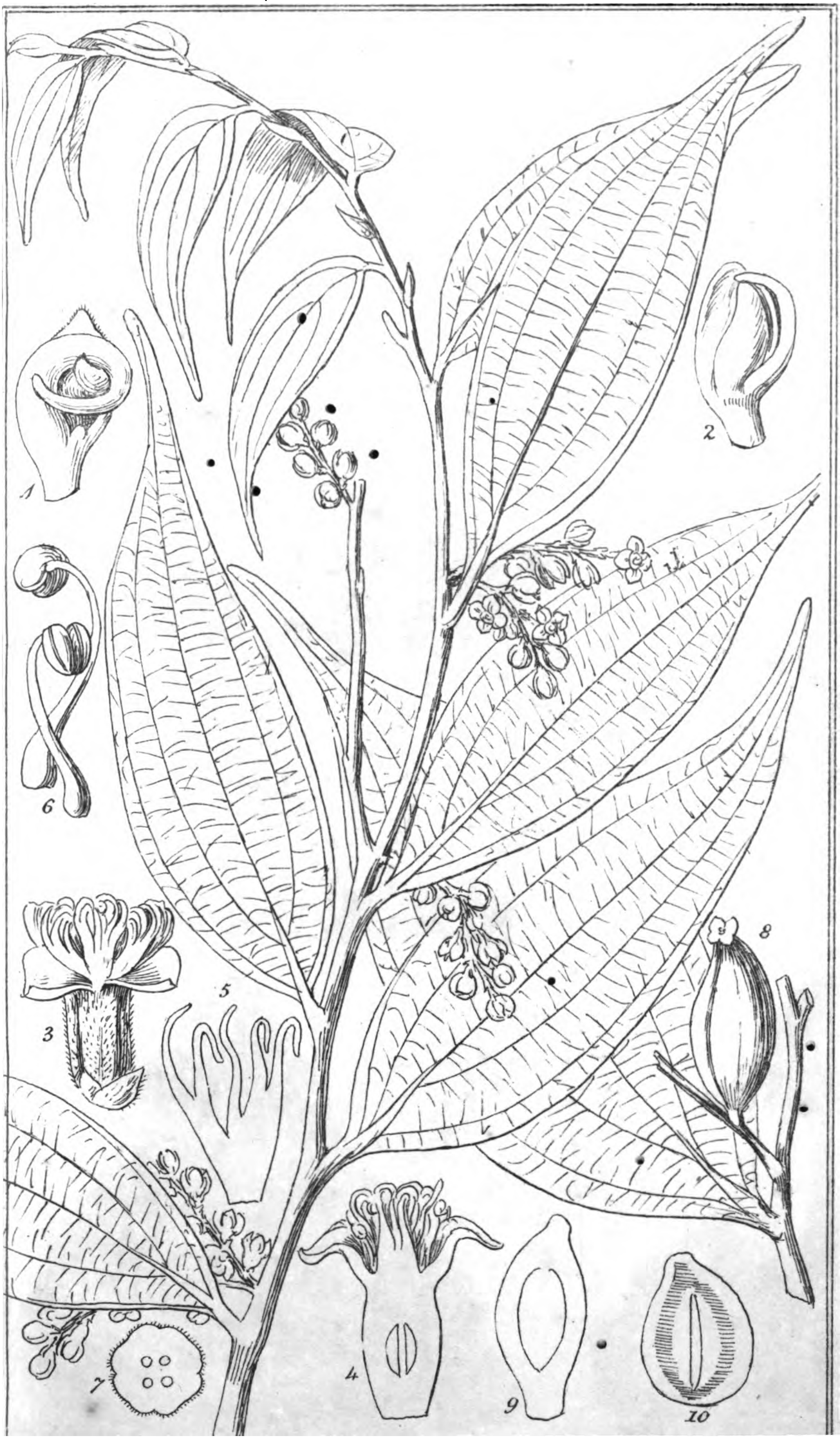

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